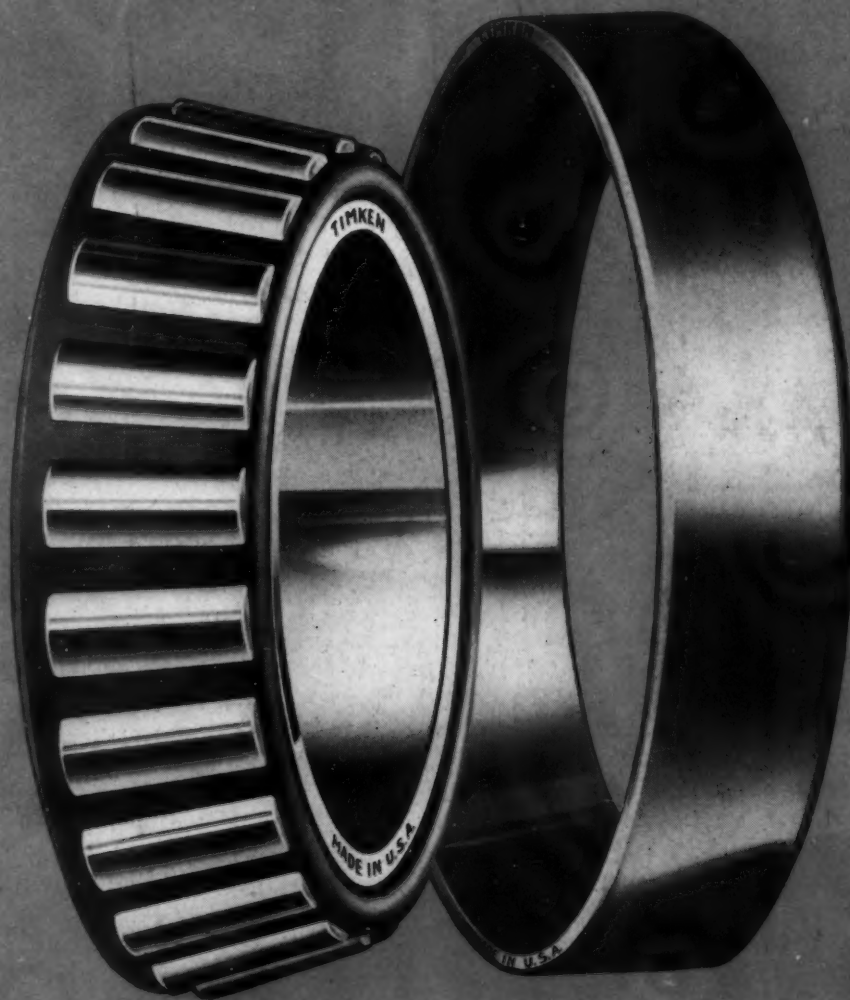


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ROADS AND STREETS

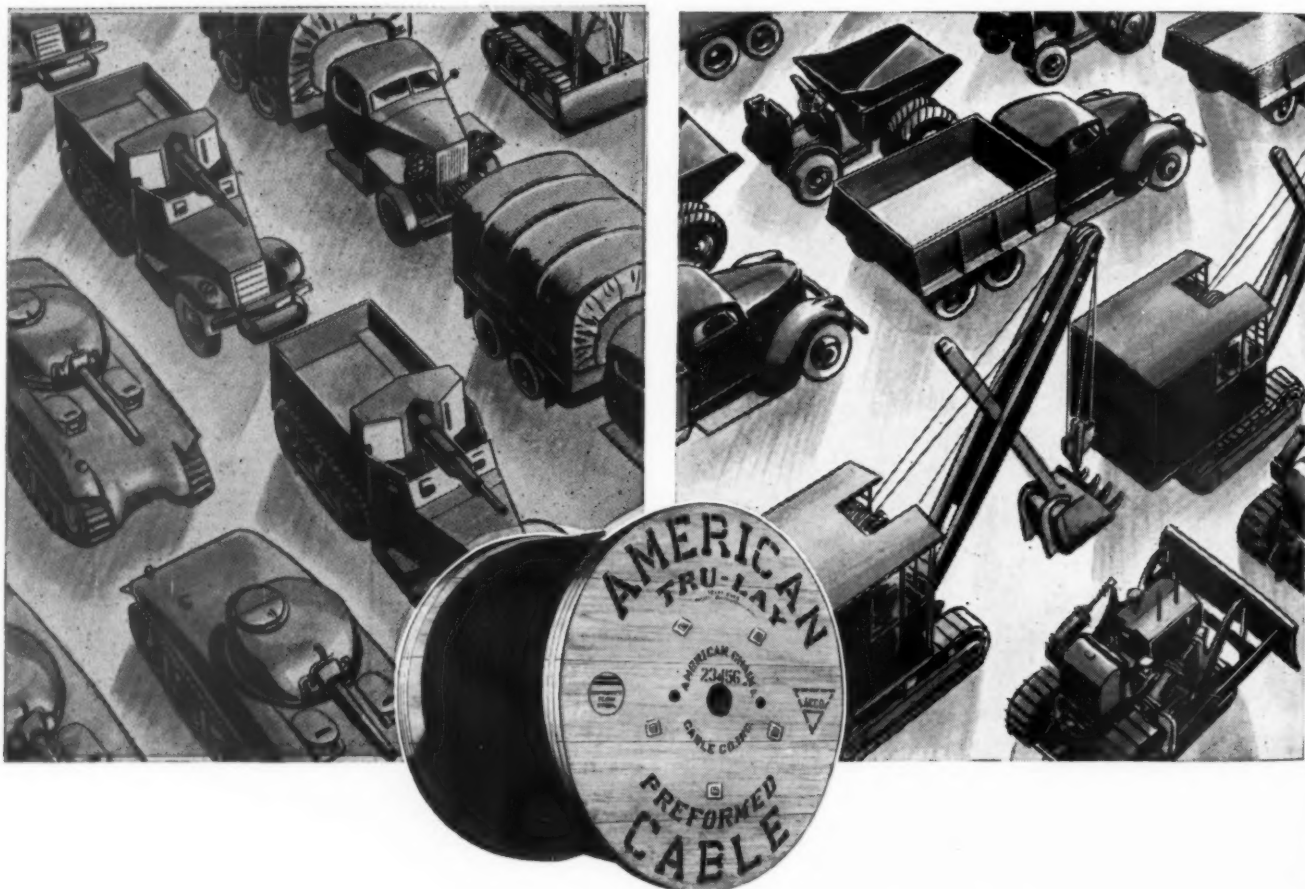
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3,000,000 jobs are now ready, thanks to the American Road Builders' Association. That organization sponsored a bill (now authorized by Congress) to provide one and one-half billion dollars of Federal money for road repair and new highway construction. To receive its share of these funds, each state must match its Federal request with a like amount of its own.

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HERE'S HOW TO SPEED UP THE HIGHWAY JOB

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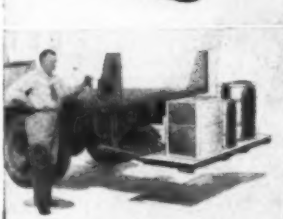
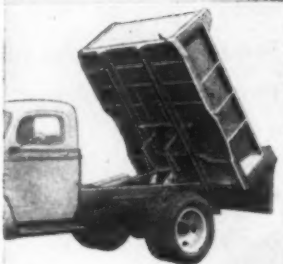
• ANTHONY MATERIAL SPREADER... rugged, all steel; for road building, maintenance and ice control.

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ROADS AND STREETS

Vol. 89

MARCH, 1946

No. 3

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A magazine devoted to the design, construction, maintenance and operation of highways, streets, bridges, bridge foundations and grade separations, and to the construction and maintenance of airports.

WITH ROADS AND STREETS HAVE BEEN COMBINED GOOD ROADS MAGAZINE AND ENGINEERING & CONTRACTING. HALBERT P. GILLETTE, President; EDWARD S. GILLETTE, Publisher; HAROLD J. MCKEEVER, Editor; CHARLES T. MURRAY, Managing Editor; H. K. GLIDDEN, Eastern Editor (N. Y.); LT. COL. V. J. BROWN, Publishing Director (Absent on Military Duty); H. J. CONWAY, Advertising Editor; L. R. VICKERS, Promotional Director.

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THIS UNIT REALLY

***GOES PLACES
AND
DOES THINGS***



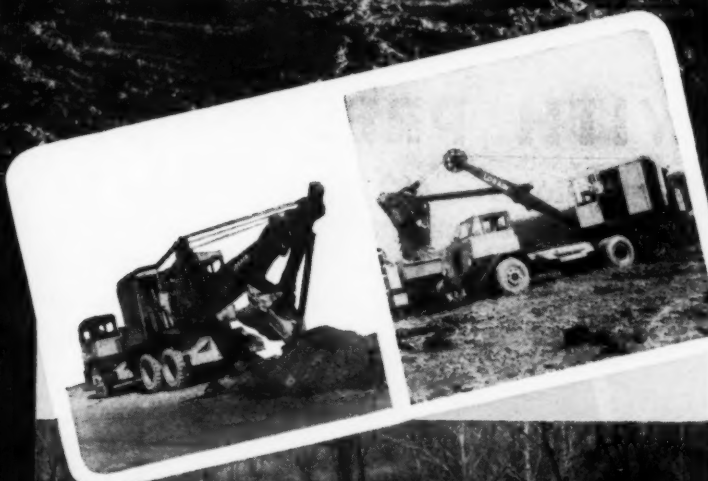
Speed is an outstanding feature of the new, powerful postwar Lorain Moto-Crane.

Speed in getting from job to job—up to 31 m. p. h. on hard surfaces—and remarkable soft-ground flotation for covering territory off the road.

Speed, too, when it's on the job excavating with clamshell or shovel, trenching with hoe, tossing a dragline, or handling materials with crane hook.

These fast, agile, rubber-tired Lorain Moto-Cranes also have greater capacity for bigger payloads and increased stability for long boom, wide radius swing.

Lorain Moto-Cranes are six wheel units with 4 or 6-wheel drive. See them in action, and let your nearest Lorain distributor explain their many other profit-making features.



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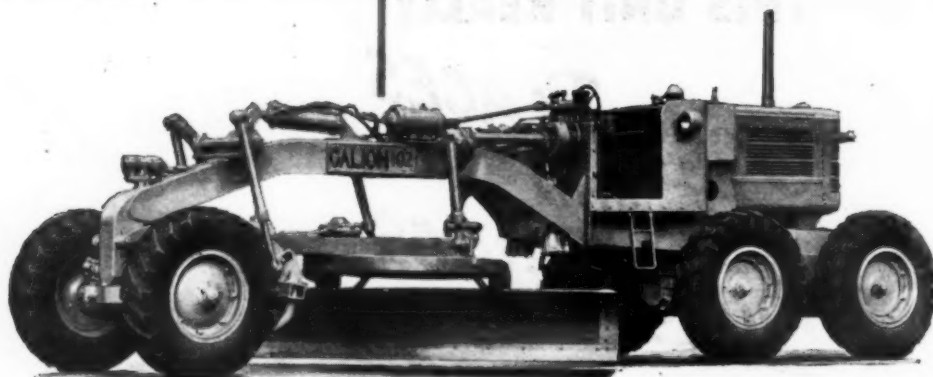
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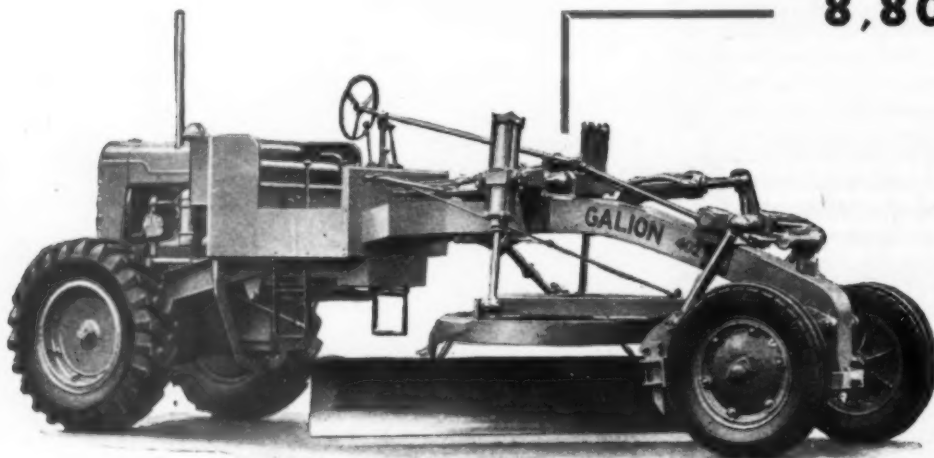


That's the weight with scarifier but less cab. Maximum blade pressure is around 13,550 lbs. and that will carry you through the toughest kind of work in road construction. This improved model No. 102 also has plenty of power—68½ H. P. diesel—full hydraulic operation, gear-driven tandem drive and a wide range of blade adjustments. You'll like it.

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The Galion No. 402 is a light baby but it packs a lot of punch for the ordinary blading work. Blade pressure with scarifier reaches 5050 lbs. and the machine, as you see it here, weighs around 8800 lbs. Has 31 H. P. Gasoline engine over rear axle and many other features.

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Northwest Crawlers give smoother travel. Front-end cab and window design provides for easy vision and there is a choice of boom hoists that provide for live boom operation independent of all other functions at the will of the operator. Everything has been incorporated to assure smooth running job that will keep the plant ahead of the paver. There are 18 sizes—4 to 44 tons capacity. Ask for further details.

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Tough Footing

... 4 Tournapulls loaded gravel in a river bed ... hauled through the water ... pulled loaded up a 12% adverse grade from the river ... and traveled 4000' to a railroad siding where they stockpiled their loads. Rigs are working for Constructores Mexicanos S.A. to supply ballast for a section of railroad near Ixtepec, Oaxaca, Mexico. In these extremely tough off-road conditions the Tournapulls' big 21.00 x 24 tires gave ample traction and flotation ... 2-wheel design provided plenty of weight on the drive wheels to furnish pulling power to climb the adverse river grades.



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from se
storm
loading
and big
through
— 525'
50,000

ETI

Steep Grades

... Nathan A. Moore's 9 Tournapulls loaded and hauled down 40 to 50% grades ... returned up 27% climb while moving ½ million yards from a mountainside at Camp Pendleton, Oceanside, Calif. Material was sandstone, mixed with clay, heavy but dry, rooted for fast loading. Despite mountainous grades and tough materials, Moore's superintendent reports that their Tournapull fleet, working over ½-mile, 1-way haul, placed 6,000 yards on the fill every 9-hour shift.



Rooted Shale

... Potts & Callahan Contracting Co., Inc., found what Tournapulls could do in tough rooted shale on Pennsylvania highway job, near Harrisburg. Using 4 Tournapulls on a 700', 1-way haul, each rig averaged a complete cycle of load, haul, spread and return every 3.55 minutes ... made 14 round trips hourly. By using a LeTourneau Rooter, smart contractors like these are extending low-cost Tournapull operation into materials formerly considered work for specialized equipment.



Rain and Snow

... Talbott & Myers Construction Co.'s 2 Tournapulls licked tough winter conditions on construction of a new General Electric building site at Lexington, Ky. Material was clay—very soggy from several weeks of rain. Next came a 4½" snow storm ... but Tournapulls proved their ability to keep loading, hauling and spreading. Positive load ejection and big-tired traction and flotation kept rigs rolling through soft, sticky fill. Hauls were short on this job—525' 1-way; Tournapulls moved 45,000 of total 50,000 yards.



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Here are some of the claims we make for MISSISSIPPI WAGONS

Check each of these statements against the owner report opposite . . . one of the many we have received testifying to the economy and versatility of Mississippi Wagons. Performance records like this are your guarantee that Mississippi Wagons have what it takes to handle your hauling jobs, at costs that will assure you of maximum profits.

1. Since the tractor is not subjected to the pounding and surging of the loaded trailer, a minimum of repairs are necessary during the life of the unit, resulting in more actual operating hours per month or year and in greatly decreased repair expense.
2. Repair parts are low in cost. The list price of all gears, bearings and shafts in the five-speed transmission is only \$188.99; of all wearing parts in the rear axle and differential, only \$315.95.
3. Short or long hauls, on or off the highway—it's all the same to versatile Mississippi Wagons.
4. The Mississippi Wagon is the only bottom-dump unit powered by a long-life industrial tractor that can haul payloads of 27,000 pounds over highways without exceeding the 18,000-pound axle-loading limit set by most state laws.
5. Mississippi Wagons provide greater flotation than semi-trailer units of the same capacity and will therefore travel over spongier ground. For the same reason, they will travel over black-top and other types of pavement without damage to the road surface.

M-R-S MANUFACTURING COMPANY, Jackson, Mississippi



Class, When
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Write us, or consult your nearest distributor, for full information on Mississippi Wagons and recommendations as to which type or types will serve you most profitably.

E. R. MORRIS

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CONTRACTORS

La. Nat'l Bank Bldg.

BATON ROUGE, LA.

September 12, 1945

Dunham-Pugh Company
Baton Rouge, Louisiana

Gentlemen:

I am pleased to give you the information requested on the four Mississippi Wagons we purchased from you on July 11, 1944.

During the first fourteen months we have owned these four Mississippi Wagons we have operated them approximately 3490 hours per unit with a repair parts bill of \$1099.87 on the tractors and \$181.65 on the trailers—a total of \$1281.52 for the four units, or \$320.38 for each unit.

In other words, our repair parts costs have been 9 and 18/100 cents an hour per unit, and the units are still in good operating condition, using about the same amount of fuel and oil they have always used.

During this fourteen months we have hauled the following quantities of material for the distances shown:

240,000 yards of dirt	average haul 1/2 mile
42,000 yards of gravel	average haul 8 miles
28,000 yards of gravel	average haul 10 miles
18,000 yards of shell	average haul 5 miles

We are now back on our dirt job at Lottie, Louisiana, finishing it up. Last winter's rains made it necessary for us to leave it as the ground conditions were quite bad, since the water level is only five feet underground on the job site.

It was very pleasing to us to have hauling equipment that permitted our taking contracts for gravel and shell hauling during those winter months, instead of having to scatter our organization and let our equipment stand idle.

In addition to their low maintenance cost and their suitability for both on or off the highway use, we are very pleased with the ability of our Mississippi Wagons to work under soft ground conditions, and with their ease of handling, operator comfort and simplicity.

I trust the above gives you all of the information requested.

Very truly yours,

MORRIS & YOUNG, CONTRACTORS

E. R. Morris

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MISSISSIPPI WAGON

The World's Most Modern Hauling Unit

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Contractor Casey was stumped...

BUT NOT FOR LONG

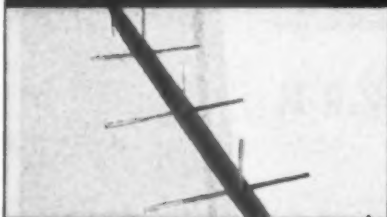
He consulted with the resident and state highway engineers . . . together they called in Ceco and the job went ahead on schedule.

The job was a big one—the kind highway contractors like. It looked like smooth sailing to Casey until lack of materials suddenly stopped the job. But not Casey! With Ceco, the resident and state highway engineers, he made changes to use available Ceco products such as Ceco Expansion Joints, Ceco Reinforcing Bars, and Ceco Contraction Road Strips. Ceco's Cecure Compound Applicator was used to finish the job. The gist of it all is that Casey completed his contract on time, within the original cost, and to the satisfaction of the resident and state highway engineers.

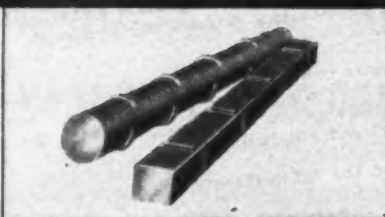
CECO ENGINEERING PLUS CONSTRUCTION KNOW-HOW . . . MAY HELP YOU WITH YOUR PROBLEMS

Ceco engineers do more than design fine highway construction products. All their wealth of technical engineering knowledge is constantly available to you, as well as their construction know-how gained by years of experience on the job in the field. In 23 offices strategically located from coast to coast, they stand ready to help solve your problems without delay, with perfect technical skill. Ceco Highway Construction Products are engineered so as to make for ease of installation and correct construction practice. So call on Ceco for engineering skill and the finest in highway products.

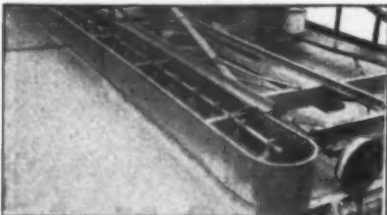
HERE ARE THE PRODUCTS THAT HELPED SOLVE MR. CASEY'S PROBLEM



Contraction Road Strip provides a positive crack to prevent irregular cracking of slabs.



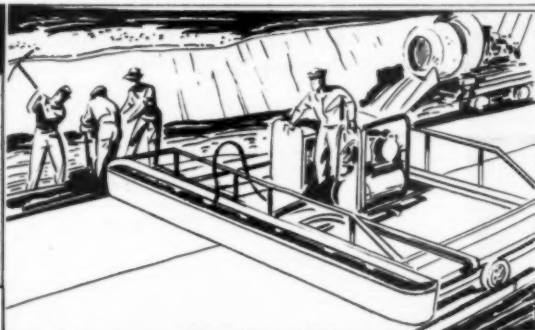
Reinforcing Bars rolled from new billet steel, in plain and deformed rounds and squares.



Cecure Applicator gives positive, even application of curing compound in one operation.



Ceco Expansion Joint; elastic, compressible, durable, waterproof. Relieves stress.



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more traction, more clearance . . .
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Up-to-the-minute in design!
Modern in performance!

A new high in productivity . .
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**It's a New Day for
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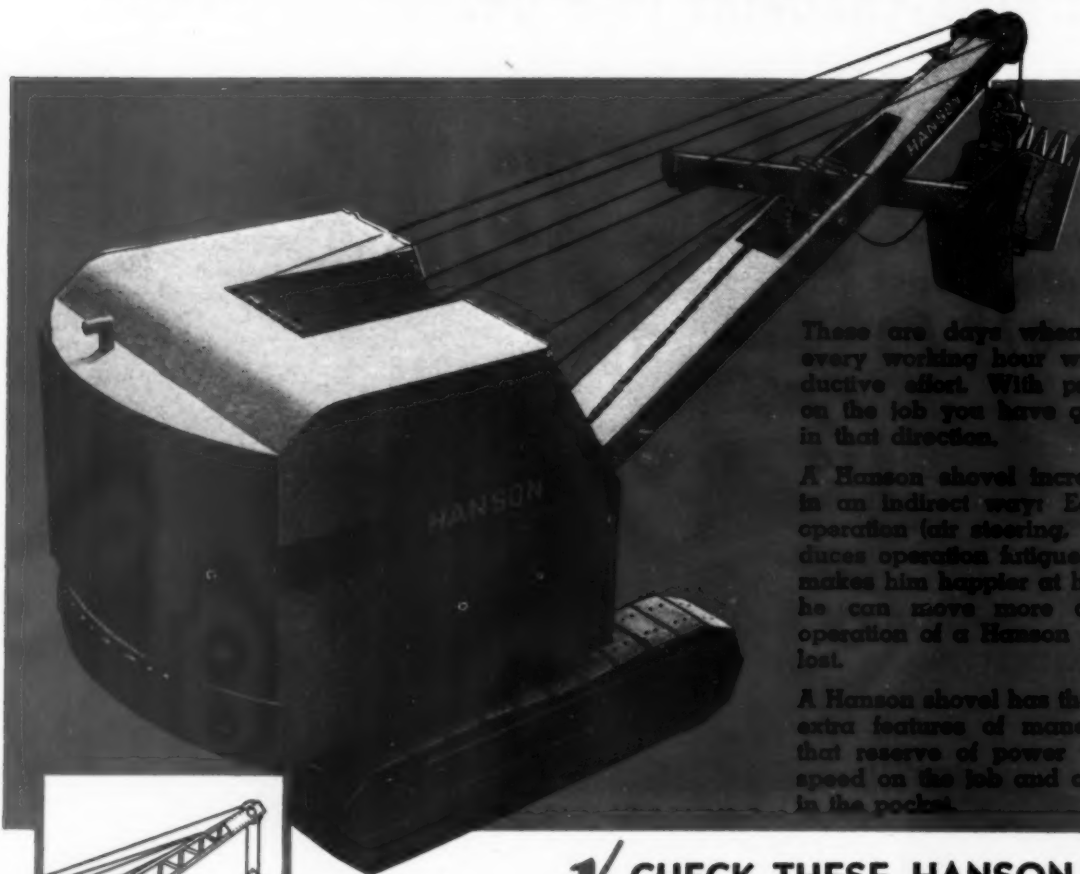
— the ideal, economical unit for countless pulling and pushing jobs—especially popular for sweeping streets, blacktop, snow.

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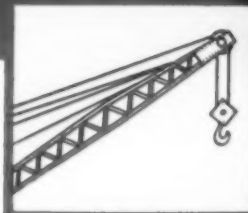
a HANSON



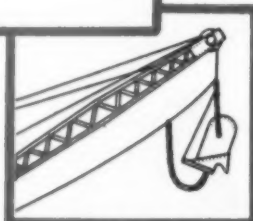
These are days when we must pack every working hour with efficient, productive effort. With proper equipment on the job you have gone a long step in that direction.

A Hanson shovel increases production in an indirect way: Easy and precise operation (air steering, for example), reduces operation fatigue, saves his time, makes him happier at his work because he can move more dirt. Trouble-free operation of a Hanson means less time lost.

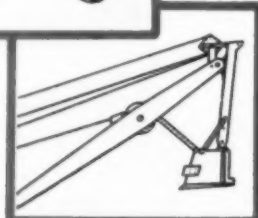
A Hanson shovel has that "plus" - those extra features of maneuverability and that reserve of power which make for speed on the job and a pleasant fingle in the pocket.



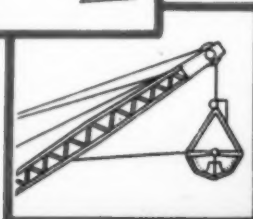
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DRAGLINE



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CLAMSHELL

✓ CHECK THESE HANSON FEATURES

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- ✓ All clutches easily adjusted and relined without removing shafts
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- ✓ Powered by heavy duty industrial type motor, Gasoline or Diesel.

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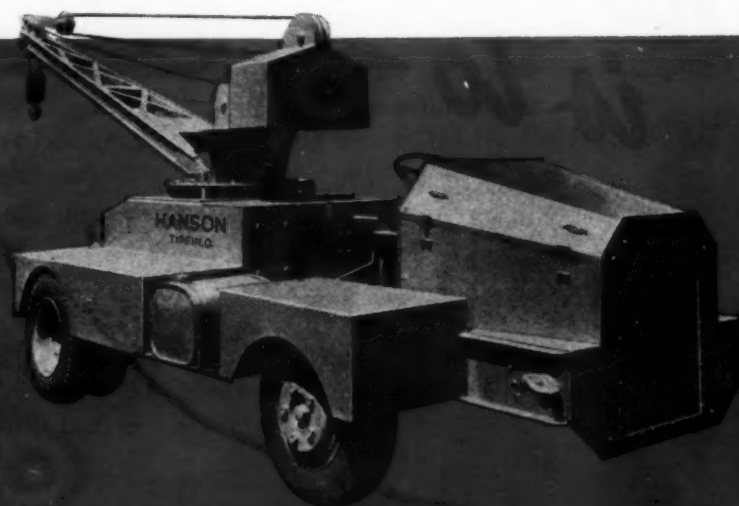
TIFFIN, OHIO

has that "Plus"

ASK ANY HANSON OPERATOR

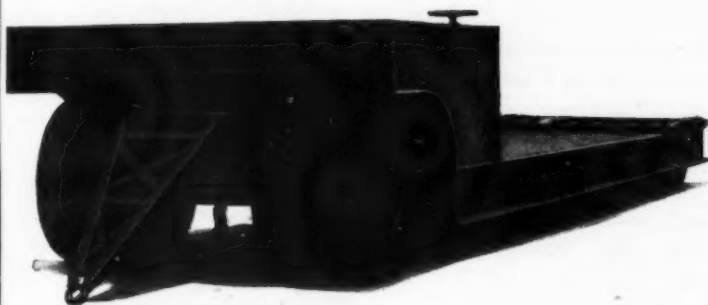
It's an all around crane on pneumatic tires that will be the busiest piece of equipment around the place. One man operated. Its 360° swing and 270° loadable arc make it unbelievably speedy and maneuverable.

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Five sizes - 10, 15, 20, 30 and 40 ton capacity.

Write for Trailer Bulletin, RS-36, indicating the size or sizes of interest to you.



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MACHINERY CO.

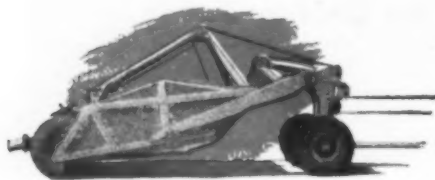
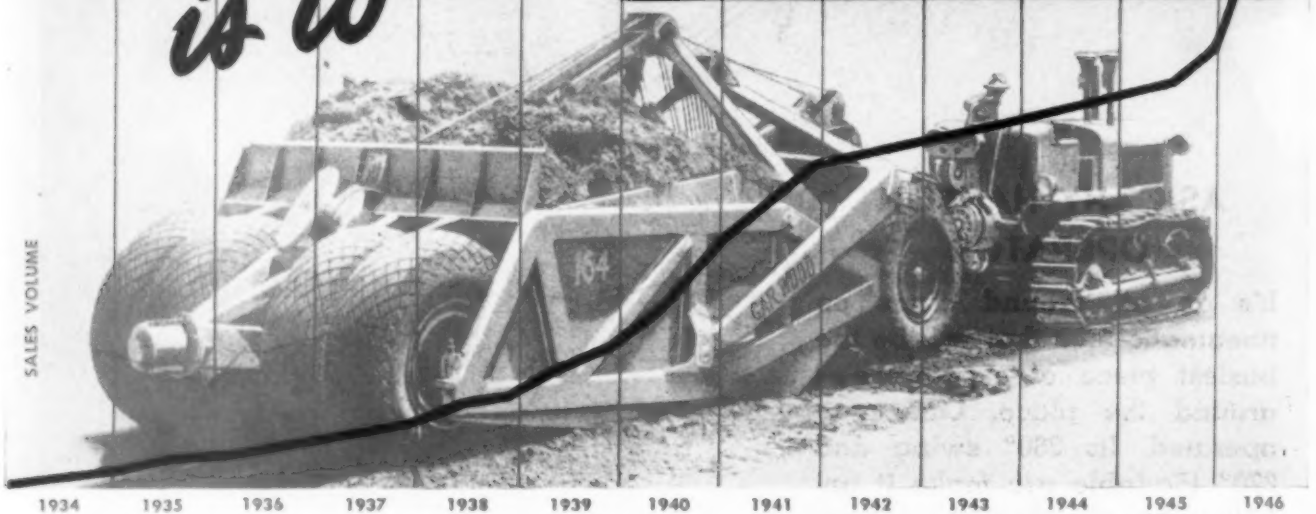
FIN ONIO, U.S.A.

*The trend
is to -*

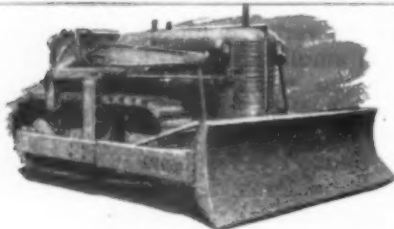
GAR WOOD ROAD MACHINERY

WITH ALLIS-CHALMERS DIESEL POWER

SALES VOLUME



4-WHEEL CABLE SCRAPERS
Capacities: 11-15-20-25 cu. yds.



HYDRAULIC DOZECASTERS with angling
blades, for all Allis-Chalmers Tractors



CABLE DOZE-CASTERS with angling
blades, for Allis-Chalmers HD-10, HD-14 and
HD-14C Tractors

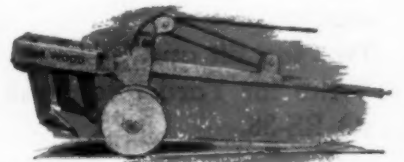


On every kind of earth moving job, throughout the world, Gar Wood Road Machinery has made good, setting new high standards of performance and workmanship.

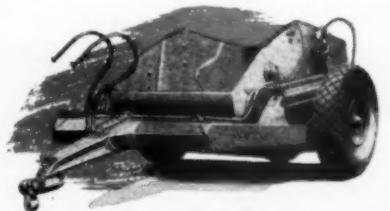
As a result, the demand for this equipment has steadily grown over a period of many years (see chart above) until now it has reached the proportions of a world-wide trend.

Here is a sound reason for specifying Gar Wood earth moving units. "Nothing succeeds like success."

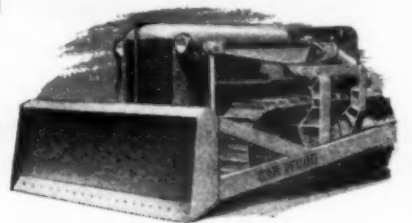
Contact your Allis-Chalmers dealer. Let him point out the superior features of Gar Wood Road Machinery and show you actual job performance in your territory with many satisfied users.



HEAVY DUTY RIPPERS
Cable and hydraulically operated



2-WHEEL HYDRAULIC SCRAPERS
Capacities: 3-5-6-8 cu. yds.



HYDRAULIC BULLDOZERS with fixed blades,
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ROAD MACHINERY DIVISION

GAR WOOD INDUSTRIES, Inc.
DETROIT 11, MICHIGAN

OTHER PRODUCTS OF GAR WOOD INDUSTRIES INCLUDE: HOISTS AND BODIES • WINCHES AND CRANES • TANKS • HEATING EQUIPMENT • MOTOR BOATS

What a **B-G** Snow Loader Does in Summer

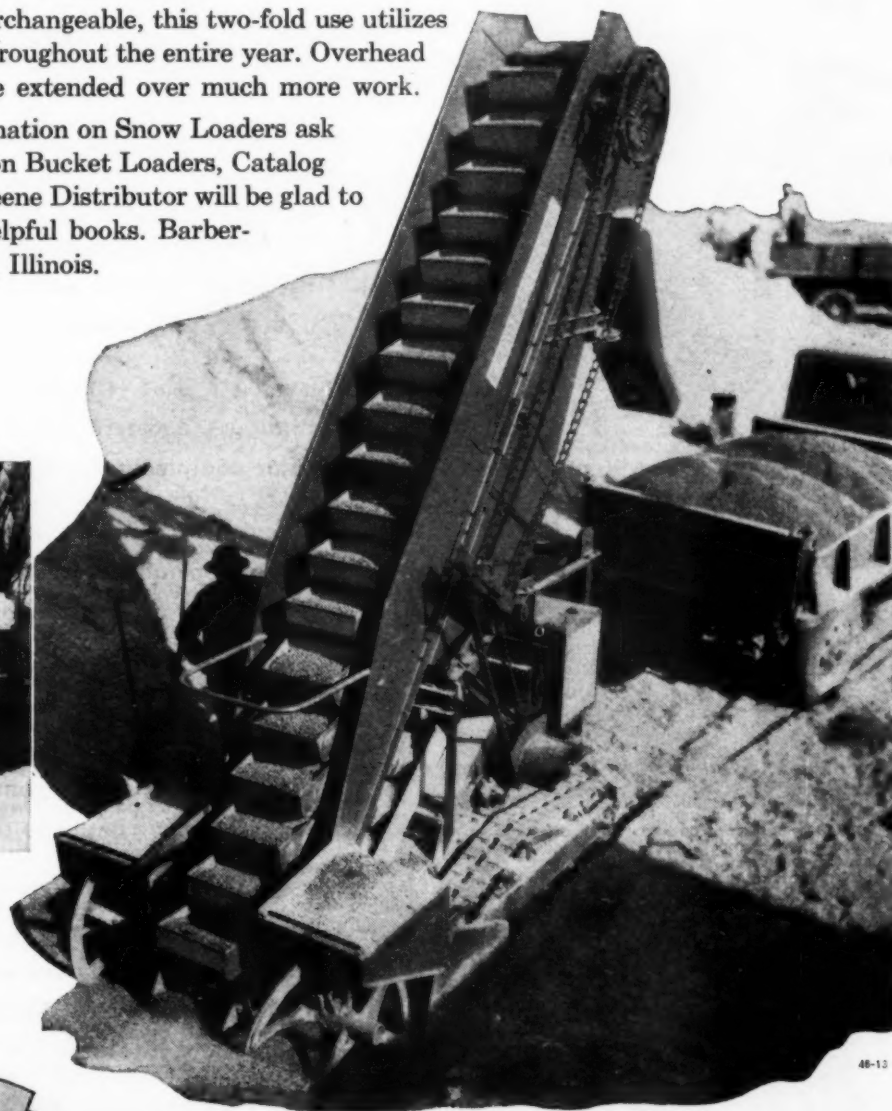
• Unlike many other types of snow handling equipment, the Barber-Greene Snow Loader can be used throughout the year. When all danger of snow is past in the spring, many municipalities and contractors turn their Snow Loaders into Bucket Loaders by substituting a standard Bucket Loader boom on the Snow Loader chassis.

Completely interchangeable, this two-fold use utilizes the same chassis throughout the entire year. Overhead and depreciation are extended over much more work.

For complete information on Snow Loaders ask for Catalog No. 538—on Bucket Loaders, Catalog No. 82. Your Barber-Greene Distributor will be glad to supply you with these helpful books. Barber-Greene Company, Aurora, Illinois.



In the urgent job of relieving congested downtown streets, the B-G Snow Loader, with capacities of 7 to 20 cubic yards per minute—depending on model—pays for itself in truck savings time alone.



48-13



CONSTANT FLOW EQUIPMENT



LOADERS • PERMANENT CONVEYORS • DITCHERS • PORTABLE CONVEYORS • FINISHERS • BITUMINOUS PLANTS • COAL MACHINES

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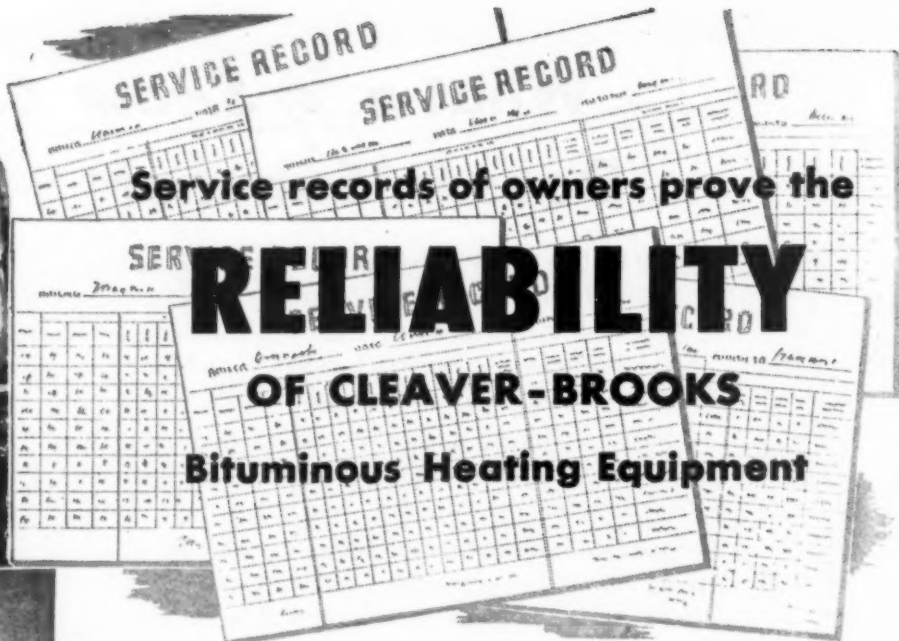
Mobile tank-car heater available in two and three tank-car sizes. Oil-fired with exclusive design four-pass flue travel; dry-coil steam condensate return under pressure—no water or heat loss.



Portable pumping booster. Heats by direct firing in one operation, loading directly to distributor, relay truck or returning to tank-car. Available in 2 sizes—truck mounting or 4 wheel trailer.



Truck mounted pumping booster in service of Oklahoma Bituminous Distributing Co., Ada, Okla.



Service records of owners prove the

RELIABILITY

OF CLEAVER-BROOKS

Bituminous Heating Equipment

- ★ Most of the pioneer models of tank-car heaters, built by Cleaver-Brooks sixteen years ago, are still in service.
- ★ There are more Cleaver-Brooks tank car heaters and bituminous boosters in service than all other makes of similar equipment combined.
- ★ Service records from hundreds of owners prove Cleaver-Brooks dependability and durability. Cleaver-Brooks equipment is usually assigned to the difficult jobs—the hardest jobs—because of its known capacity and reliability.
- ★ The design and construction of Cleaver-Brooks heating equipment is subject to constant check—to include every feature that contributes to the most effective performance and long service life.
- ★ Cleaver-Brooks heaters are the “finished” product of the pioneers and originators of tank-car heaters and bituminous boosters—built by specialists in the construction of portable and stationary steam generators.

On your next bituminous heating equipment purchase you can expect to get more value from Cleaver-Brooks—qualified by experience and facilities in this specialized field.

CLEAVER-BROOKS COMPANY

329 E. Keefe Ave.

Milwaukee 12, Wis.

Cleaver-Brooks

PIONEERS AND
ORIGINATORS OF

TANK CAR HEATERS . . . BITUMINOUS BOOSTERS . . . AUTOMATIC STEAM-PLANTS

At last

Small SCRAPERS for light earthmoving!



Just the thing for ditching and shoulder work . . . repairing slides and washouts . . . filling in around culverts and bridge abutments.

A Practical Tool for all light excavation, stripping, grading and hauling. Thrifty to buy . . . easy to operate . . . simple to maintain.



Now Dozens of Small Jobs Can Be Handled Faster, Cheaper, Better Than Ever Before

C Up until now, small earthmoving jobs have always been a problem because there has been no equipment available to handle them efficiently. Today, however, LaPlant-Choate offers you a dependable line of small scrapers especially designed for light earthmoving and already job-proved by extensive wartime use.

Whether you select the thrifty 2-yard design with gravity dump, or the larger 4-yard model with positive forced ejection and controlled spreading, remember both are easily adapted for use with crawler-type or high-speed, rubber-tired industrial tractors. Both are equipped with LPC's improved, single-unit hydraulic system for faster, more dependable operation. Both are skillfully engineered and ruggedly

built to move earth at lowest possible cost per yard within their respective job ranges. For better results and bigger profits tomorrow, get complete facts today on these two great new LPC "Carrimors". Just address: LaPlant-Choate Manufacturing Co., Inc., Cedar Rapids, Iowa; Oakland, Calif.

ESTIMATED YARDAGE TABLE

• Here's a reasonable estimate of the number of yards moved per hour by LaPlant-Choate C-22 and C-42 scrapers behind high speed rubber-tired tractors of 22-28 DHP and 40-50 DHP respectively. Yardage is based on self-loading in good scraper material, with properly maintained haul roads.

Model	LENGTH OF HAUL IN FEET								Load, Turn and Dump Time	Pay Yards Per Trip
	200'	300'	400'	500'	600'	800'	1000'	2000'		
C-22	38	32	29	26	24	22	21	17	1.5 Min.	1.75
C-42	69	59	55	52	50	46	44	32	1.75 Min.	3.75

LaPLANT - CHOATE

Engineered Earthmoving

lowest possible cost per yard

**STEPPING FROM AUTO
TO TRUCK OR BUS**

DOESN'T INCREASE A MAN'S STRENGTH OR STATURE

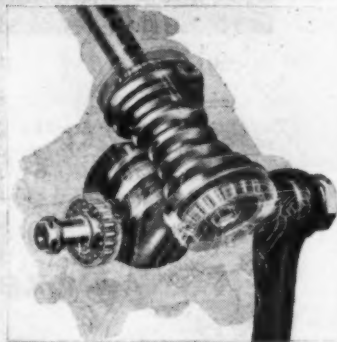


● Since Gemmer pioneered ease of steering, the vast majority of passenger cars have it. A truck or bus driver gets used to it in his own car.

● But when this driver steps into the cab of a truck or bus having ordinary steering, he has to be ready to exert greatly increased effort on the steering wheel.

● He cannot be expected to grow in the act of changing from his car to truck or bus. Gemmer Steering **MAKES CERTAIN HE DOES NOT HAVE TO**—the vehicle so equipped has passenger car ease of steering. It is quite natural that Gemmer equipped vehicles are preferred by drivers. Fleet owners and operators prefer vehicles so equipped because decreased driver fatigue makes for quicker trips, fewer accidents.

● Gemmer Steering Gears are simple, efficient, sturdy. An hour glass worm mounted on roller bearings bears on gear teeth that roll. Roller tooth and roller bearings banish friction, minimize wear. There is no lost motion; rarely, if ever, need for maintenance. Steering is always firm, responsive, positive, with absence of rubbery feeling or wander.



● **GEMMER...The Symbol of Steering Excellence**

**STEERING WON'T PUT EXTRA
DEMAND ON THE DRIVER IF IT IS
GEMMER STEERING**

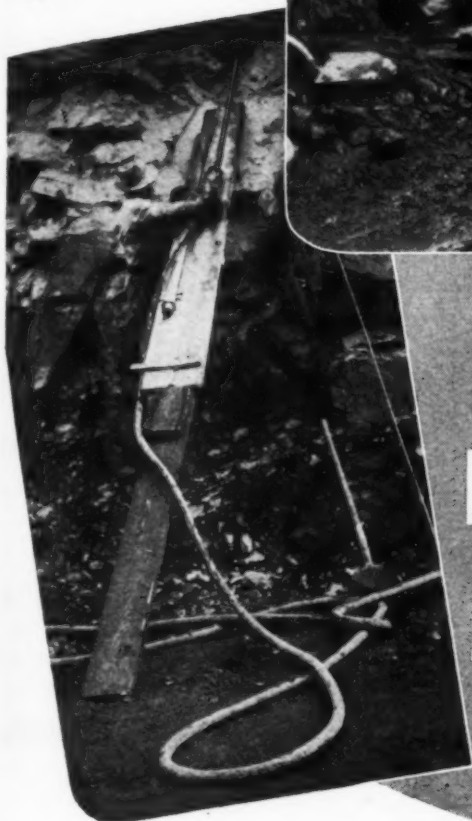
GEMMER MANUFACTURING CO., 6400 MT. ELLIOTT, DETROIT 11, MICH.

Drilling a high breast hole. Note the use of a second plank 2" x 12" x 20' with block nailed on same to hold 10-foot board.



Drilling lifters. The feed bar is secured to a plank (2" x 12" x 10') by the use of two U-bolts. Notch at back of plank fits the pin to prevent side movement.

It's easy to change steels—simply swing the machine around the feed bar.



A PROFITABLE APPLICATION OF



THE CLEVELAND HC10 AIR FEED SINKER

Contractors, widening cuts and grades on road work, can duplicate this use of the Cleveland HC10 to great advantage.

The three illustrations with their captions, fully explain this system which makes it possible to switch from lifters to breast holes with a minimum of delay. Besides the speed and simplicity of this assembly of the HC10, you gain many other advantages with this air feed sinker: 1. Feeding into the rock is quick, steady, and easy with the

air cylinder. 2. The return is just as easy, and very simply done, by hand. 3. Throttle and air feed controls are conveniently placed, easy to get at, in all positions. 4. Exhaust is readily directed where you want it. 5. Air and water connections are straight away, in the rear of the backhead.

We also make sinker drills, paving breakers, wagon drills, clay diggers, tampers, accessories and a complete line of pneumatic tools for shop use.

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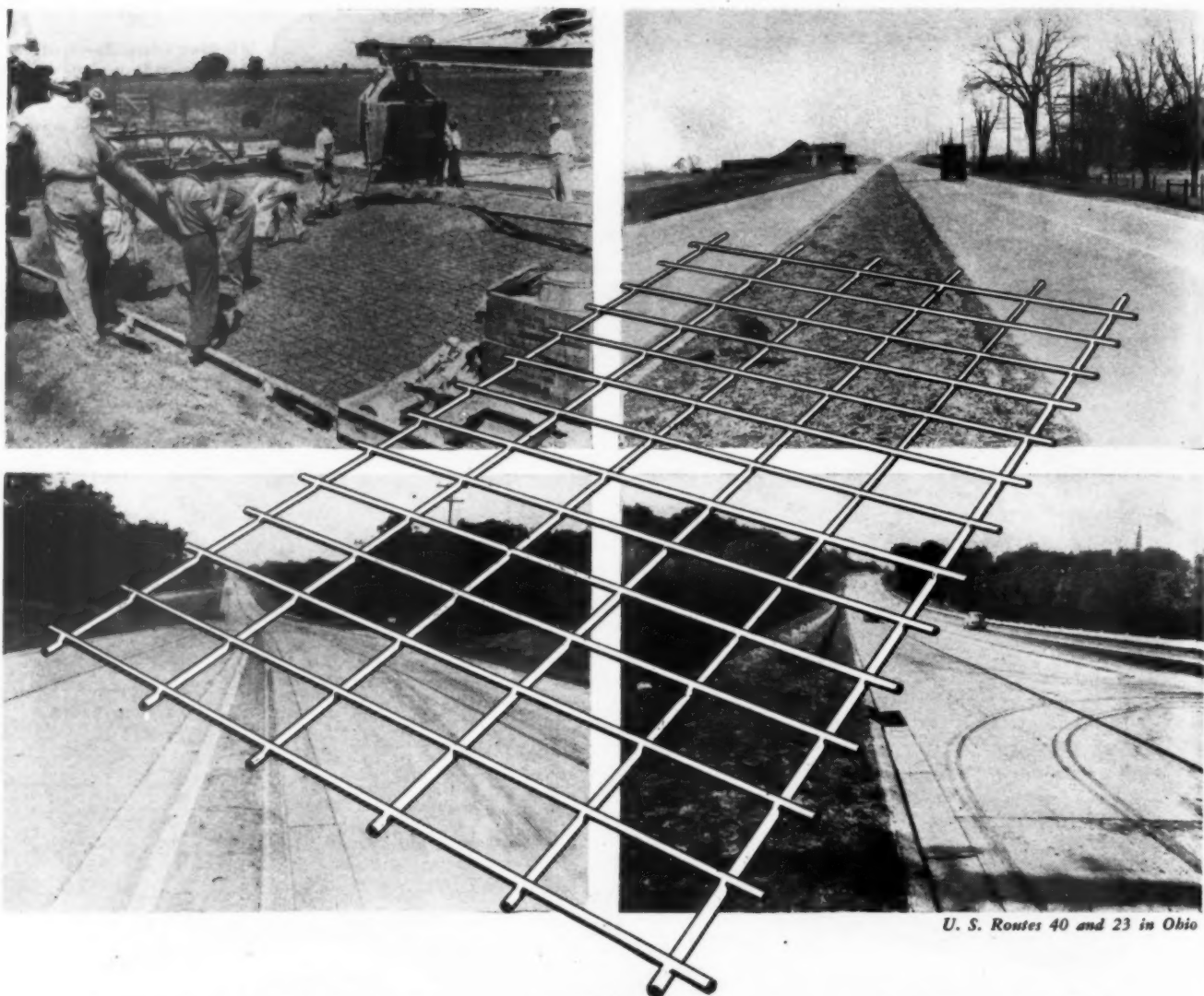
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U. S. Routes 40 and 23 in Ohio

America's Finest Concrete Highways are reinforced with **TRUSCON WELDED STEEL FABRIC**

In every section of the country . . . in transcontinental and Canada to Gulf highways . . . in community super-highways . . . Truscon Welded Steel Fabric Reinforcement is assuring low cost and long life for concrete.

Engineers and designers have found by experience, practice and research that the following advantages can be expected from Truscon Welded Steel Fabric:

Provides resistance to cracking

due to shrinkage of concrete during setting period.

Provides tensile strength necessary to resist subgrade friction caused by expansion and contraction of the concrete slab.

Provides increased resistance to cracking of concrete due to warping.

Provides resistance to the development of microscopic cracks into visible cracks.

Provides resistance to cracks opening and allowing entrance of water.

Provides resistance to broken

ends of slabs separating at a crack.

Decreases spalling and progressive disintegration of the concrete.

When you plan roads, plan them well. Use structural designs that have been proved the most economical, durable and serviceable in the *long run*. Use Truscon Welded Steel Fabric with other associated Truscon roadbuilding products, and assure lasting prestige for you and more permanent highways for the communities you serve.

TRUSCON STEEL COMPANY • Youngstown 1, Ohio • Subsidiary of Republic Steel Corporation

TRUSCON

WELDED STEEL FABRIC
Covers the Continent

Firestone

Announces

A SENSATIONAL NEW OFF-THE-HIGHWAY TIRE

the
Wire Cord

AGAIN Firestone pioneering leads the way with another epochal development — THE FIRESTONE WIRECORD Off-the-Highway Tire.

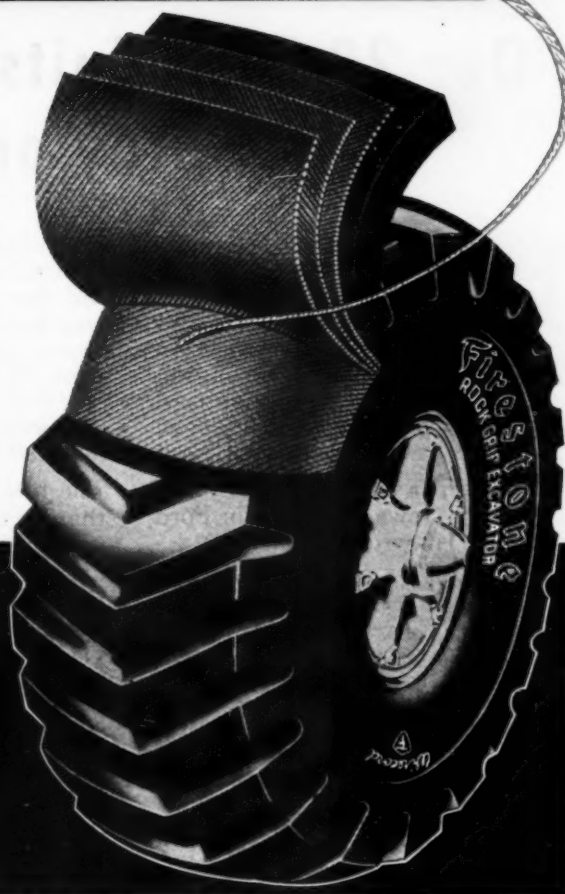
In this, the strongest tire ever built, the body cords are twisted strands of wire. Every cord in every ply is five times as strong as the strongest cord heretofore used.

This cooler-running tire takes unbelievable punishment without blowing out, puncturing, or failing from any of the causes that ruin ordinary tires prematurely.

FIRESTONE WIRECORD Off-the-Highway Tires are now proving their superior performance in logging, strip-mining and other operations where the vehicle is forced to travel over rough roads under heavy loads.

Although not yet in volume production, this amazing new type tire is another example of Firestone's leadership in bringing you the Best Today . . . Still Better Tomorrow.

Copyright, 1946, The Firestone Tire & Rubber Co.



Firestone
Wire Cord
OFF-THE-HIGHWAY TIRE

Better Trucks *for YOUR Business!*

TRUCK-ENGINEERED • TRUCK-BUILT • BY TRUCK MEN



"Our 20 Ford Units Stay on the Job"

It doesn't take long for the profit on a job to vanish, if truck equipment can't stand the pace. That's why the rugged reliability and endurance of Ford Heavy Duty Trucks have made them such favorites in the construction field as well as on street and highway work.

Contractor C. W. Shirey, of Waterloo, Iowa, is strong for Ford Trucks. He wrote recently:

"The splendid way we've been able to maintain our Ford units, handling ready-mix concrete deliveries, for the last ten years, has been very

gratifying. Eleven of our twenty Ford units carry mixer equipment, and they've been going every day, long hours—especially all through the war period. Through the service given by our Ford dealer, we've kept them running, and kept tie-ups to a minimum. Rest assured we'll continue to use Ford units."

The new Ford Trucks are better than ever—engineered for more economy, more reliability, longer life. There's a new Ford Heavy Duty Dump Truck chassis that's a stand-out value. Ask your Ford Dealer about it!

FORD TRUCKS

MORE FORD TRUCKS ON THE ROAD • ON MORE JOBS • FOR MORE GOOD REASONS



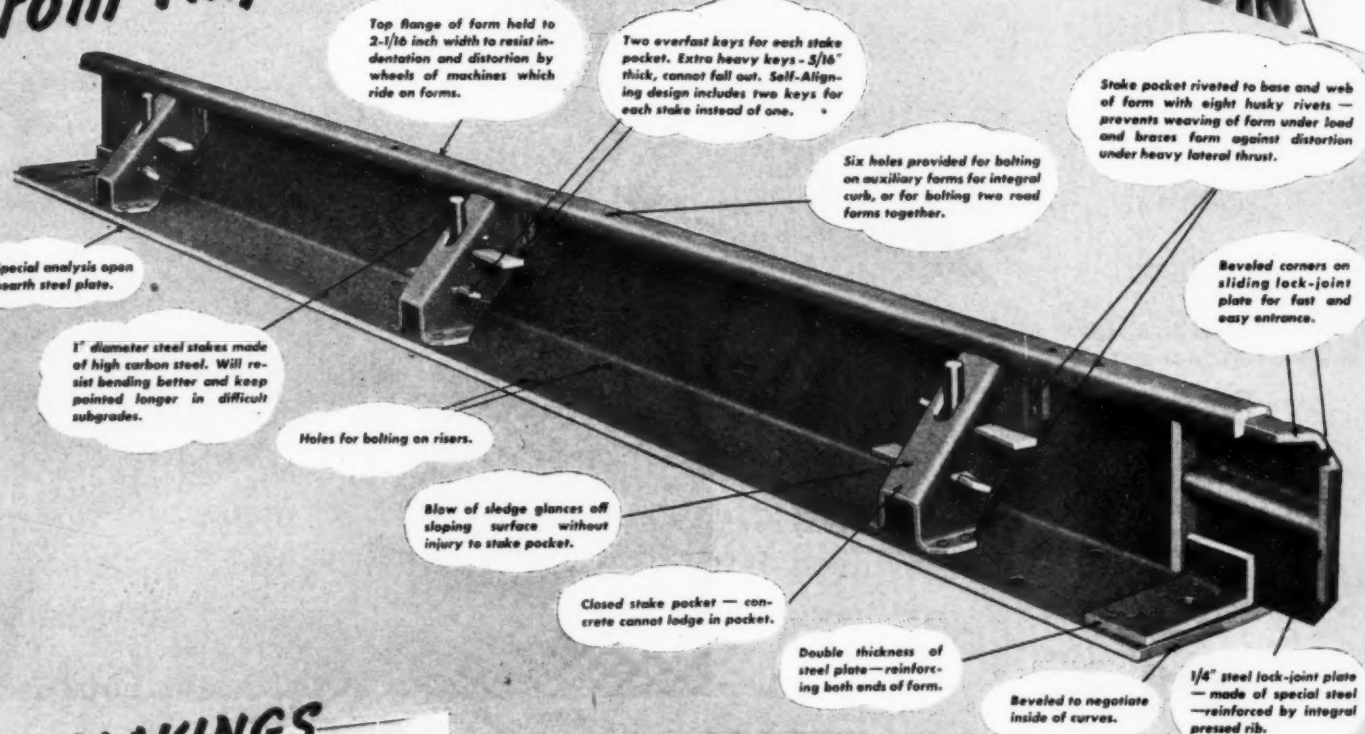
ADVANCED ENGINEERING IN NEW FORD TRUCKS

*More Economy and Endurance
Easier Servicing*

A STILL GREATER 100 HP V-8 ENGINE with NEW Ford steel-cored Silvaloy rod bearings, more enduring than ever in severe service • NEW aluminum alloy cam-ground 4-ring pistons for oil economy • BIGGER, more efficient oil pump and IMPROVED rear bearing oil seal • NEW longer-lived valve springs • NEW improvements in cooling • NEW efficiency in ignition • in carburetion • in lubrication • in ease and economy of servicing operations • And available in all truck chassis except C.O.E. units—the rugged, thrifty 90 HP FORD SIX-CYLINDER ENGINE, with many important advancements.

FORD CHASSIS ADVANTAGES: Easy accessibility for low-cost maintenance • Universal service facilities • Tough, forged front axles • Extra-sturdy rear axles with pinion straddle-mounted on 3 large roller bearings, ¾-floating type in light duty units, full-floating in all others • 3 axle ratios available (2 in 1-ton unit) • 2-speed axle available in heavy duty units at extra cost • Powerful hydraulic brakes, large drums, cast braking surfaces • Rugged 4-speed transmission with NEW internal reverse lock optional at extra cost on light duty units, standard on all others.

Expect and get BLUE RIBBON PERFORMANCE From Improved PAVING FORMS



THE MAKINGS



of more than
1,000,000 feet of Blaw-Knox paving
forms which went to War.
Part of a stock pile of steel plates in the Blaw-Knox yards
during the war period.

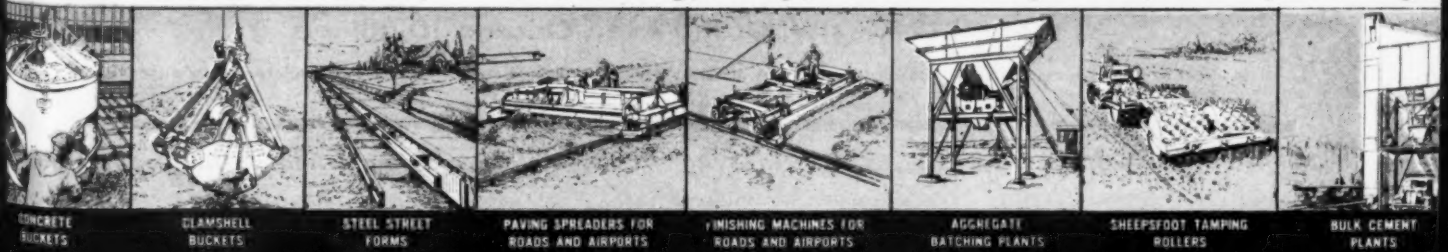
The choice of men who do high speed concrete paving of roads and airports, who appreciate the blue ribbon performance they get from the improved Blaw-Knox Self-Aligning Paving Form.

- It's the only self-aligning paving form on the market and can be set faster and more accurately.
- Form alignment is undisturbed when stakes bend over the stake due to an obstruction.
- Less experienced form setters can be used.
- Improved reinforcement for rigidity and durability. Husky rivets and no countersinking of holes in form plate.
- Available in 5 gage (7/32") or 1/4" special analysis open hearth steel plate.

Study the features of Blaw-Knox Paving Form - learn more about them in Bulletin No. 2037 (we'll send you a copy) - know all the desirable factors that insure faster, better and cheaper form setting on your paving job.

BLAW-KNOX CONSTRUCTION EQUIPMENT

BLAW-KNOX DIVISION OF BLAW-KNOX CO., Farmers Bank Bldg., Pittsburgh, Pa. • New York • Chicago • Philadelphia • Birmingham • Washington





Concrete gives *low annual cost* service on urban limited highways such as Detroit's Industrial Expressway.

Concrete also provides strength and economy for rural roads such as this section of U. S. Highway 209 in Monroe County, Pennsylvania.



CONCRETE gives low-annual-cost pavement service

The strength and stamina of portland cement concrete pavement enables it to give long years of all-weather service.

For all but the lighter traffic, concrete pavement designed according to sound engineering principles usually costs less to build than any other pavement of equal load-carrying capacity.

LOW MAINTENANCE COST

Although the smooth-riding and all-weather safety of concrete roads generally attract the heaviest traffic, annual maintenance costs of concrete pavement have been lower than for other

types of paving. This was true even during the war years when concrete roads had to carry heavy overloads of industrial traffic.

LOW ANNUAL COST

Low first cost, low maintenance expense and long life mean *low annual cost*—the reason why portland cement concrete is the logical pavement for new principal urban and rural highways and streets.

Write for data on latest concrete pavement designs for roads, streets or airports. Free in United States and Canada.

PORTLAND CEMENT ASSOCIATION

Dept. 3-28, 33 W. Grand Ave., Chicago 10, Illinois

A national organization to improve and extend the uses of concrete . . . through scientific research and engineering field work

Another **REPEAT ORDER** *from the* **EMPIRE STATE..**

NEW YORK STATE

... THE 4TH REPEAT PURCHASE OF FWD TRUCKS BY NEW YORK STATE

The recent purchase of 37 FWD Model YU Trucks by New York State marks the fourth repeat purchase by Empire State Departments. There are 121 FWD trucks already in service with New York State; this additional purchase of 37 Model YU's brings the FWD fleet total to 157 trucks.

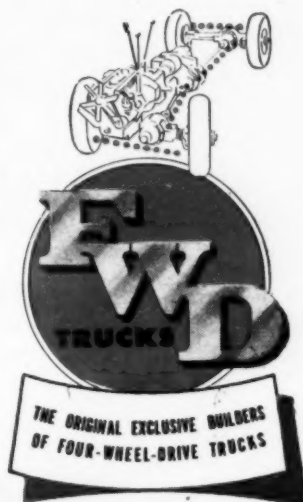
All season service...speed...stamina...full four-wheel-drive...plus modern styling of body and chassis...in every detail dependable, rugged highway workers—FWD trucks are deservedly the first choice of state and highway officials everywhere.

THE FOUR WHEEL DRIVE AUTO CO., Clintonville, Wisconsin

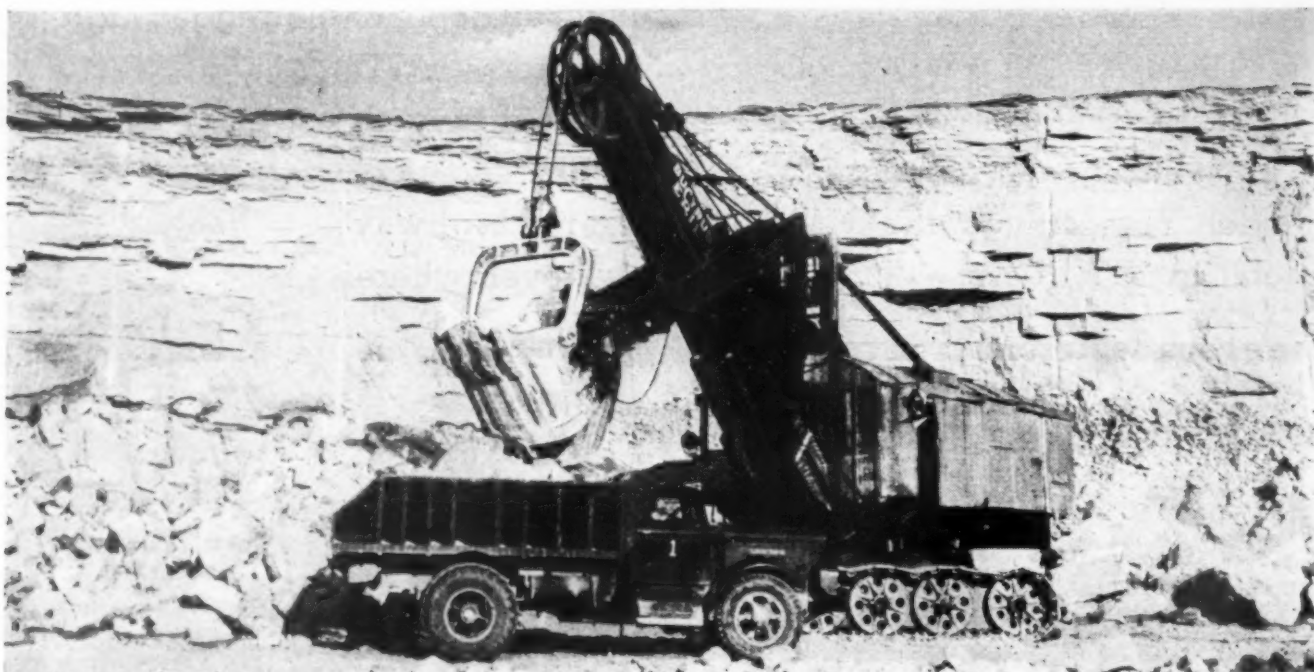
Canadian Factory: KITCHENER, ONTARIO

NEW YORK BRANCH — 175 E. 156th Street, New York City
(Near Yankee Stadium)

One of the trucks on the recent purchase of 37 FWD Model YU's by New York State.



All Point Efficiency with **SINCLAIR** **SPECIALIZED LUBRICANTS**



CONTINUOUS efficient operation demands no failure of any mechanical part. Good engine lubrication is not enough. Proper ALL-POINT protection is vital. Sinclair lubricants are designed for *specific* service at every individual point.

For *engines*... Opaline Motor Oil provides unvarying, safe lubrication. Its qualities combat ring sticking, resist carbon and crankcase accumulations, help avoid bearing corrosion.

For *gears*... Opaline Gear Lubricant provides extreme pressure properties to prevent galling and scuffing. It resists oxidation, flows

freely at low temperatures, and won't foam at high speeds.

For *chassis*... non-dripping Opaline Chassis Lubricant stays put. Its basic oil provides sure lubrication under extreme pressure. For *wheel bearings*... Sincolube meets all requirements of ball and roller bearing engineers. It doesn't thicken or thin out with temperature variations or separate during use.

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Try these specialized lubricants for efficient, economical operation of each important mechanical service.

SINCLAIR AUTOMOTIVE OILS

FOR FULL INFORMATION OR LUBRICATION COUNSEL WRITE SINCLAIR REFINING COMPANY, 630 FIFTH AVENUE, NEW YORK 20, N. Y.

"CATERPILLAR" DIESELS

Stand out because they Stand up



When a competitor says "Those 'Caterpillar' folks are quality-crazy," it's taken as a real compliment. For quality in all products is the first thing "Caterpillar" research engineers, designers, metallurgists and manufacturing heads think about. . . .

Quality that means dependable performance—no costly interruptions, no long or frequent down time. Quality that gives owners low fuel and other operating costs. Quality that assures low maintenance. Quality that reduces repair expense and parts replacements to the minimum. Quality that enables "Caterpillar" equipment to *stand up*—to lick the tough jobs, run many thousands of hours, assist the contractor to do good work at a sub-

stantial saving to his customers and at an attractive profit to himself.

What is a typical tough job? Levee building, for one. Working in heavy, sticky Mississippi River gumbo in particular. On the project spot-illustrated here, Luhr Bros. Construction used a fleet of scraper-operating "Caterpillar" Diesel Tractors of both track and wheel types. "Zoning" the equipment to fit the hauls and other needs speeded the work, cut cost, made more money.

Floodlighting, for double-shift operation, with a portable "Caterpillar" Diesel Electric Set helped further to shorten the completion time, enabled earlier release of equipment.

CATERPILLAR TRACTOR CO., PEORIA, ILLINOIS

CATERPILLAR DIESEL

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ENGINES • TRACTORS • MOTOR GRADERS • EARTHMOVING EQUIPMENT



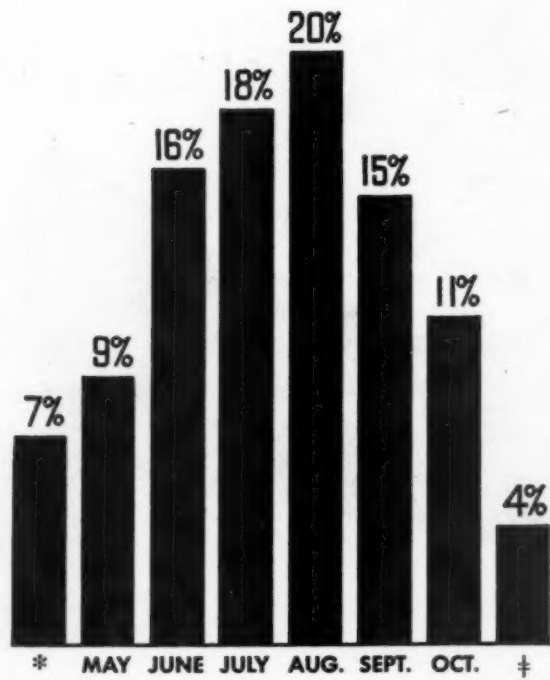
The discharged veteran wears this emblem.
Remember his service and honor him.

Now, more than ever, it will pay you to ...

1. Schedule Asphalt work early
2. Work on schedule

ALL SIGNS point to a big season ahead in road construction and repair. Although the material and manpower shortages and transportation difficulties of the past war years will not be with us, farsighted contractors and highway departments are planning to start their programs as early in the season as possible. Here's why:

The chart at right shows average asphalt shipments each month in a normal year. It indicates when road work is normally done. Naturally, it is heaviest in four summer months. But think what the abnormal demands for materials expected in the coming season may mean if normal buying and work scheduling are followed. It could mean a temporary shortage not only of asphalt but of aggregate and other materials, as well as the over-taxing of equipment and manpower.



* PRIOR TO MAY 1 † AFTER OCT. 31

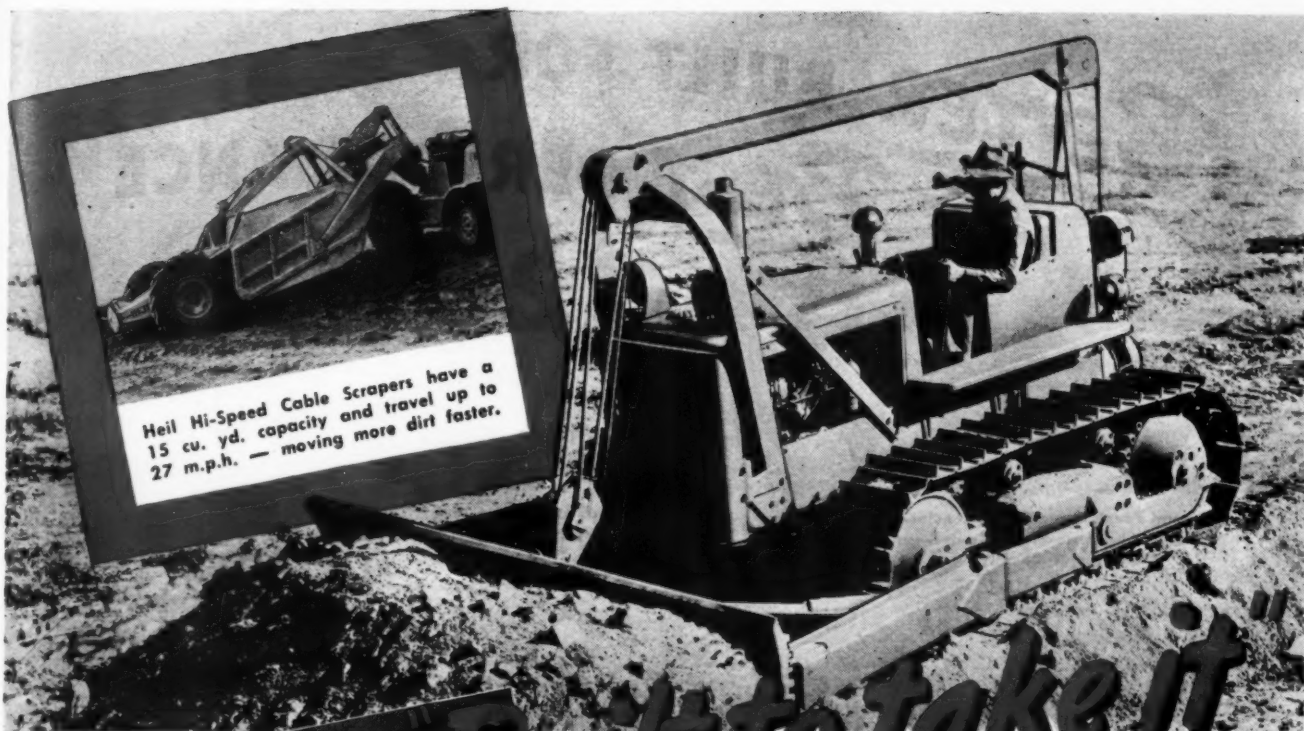
Average yearly asphalt shipments by months, indicating when road work is normally done.

Your best insurance against these troubles is to schedule work early. Then, after determining your asphalt needs, let Standard Oil supply them for fast, prompt shipment from its five large, convenient refineries in the Midwest. See the Standard Oil Asphalt Representative in your locality on any problems concerning asphalt. Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD OIL
ASPHALT

STANDARD OIL COMPANY (INDIANA)

**STANDARD
SERVICE**



Heil Hi-Speed Cable Scrapers have a 15 cu. yd. capacity and travel up to 27 m.p.h. — moving more dirt faster.

Built to take it

Heil Cable Dozers

deliver outstanding

"on-the-job" performance

To move "pay dirt" quickly, easily, and economically, Heil Cable Dozers give you these "job-designed" features:

The center-lift construction assures full visibility. 60% of the moldboard is visible at all times . . . your operator can work quickly and accurately. Short push-arms at center balance point provide greater down-pushing pressure on blade cutting edge, for maximum penetrating power. Down pressure at center point of tractor keeps track at full length on ground, utilizing entire drawbar horsepower of tractor. There are dozens of other features that make famous Heil Cable Dozers perform like champions. . . . You're money ahead from the very start when you specify Heil Quality-Built Cable Dozers. Write for bulletin or

R-62



Heil Hi-Speed Bottom Dump Wagon, interchangeable with Scraper, cuts hauling time — speeds dumping.



Dependable Heil Power Control Units are designed for all types of cable-operated equipment.

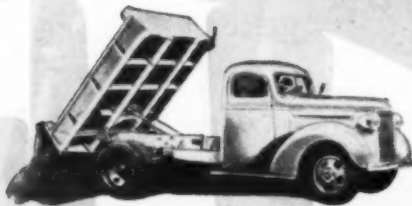
THE HEIL CO.

GENERAL OFFICES • MILWAUKEE 1, WISCONSIN

BETTER BUILT FOR BEST PERFORMANCE



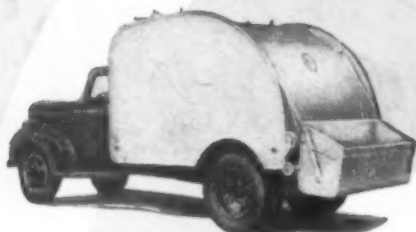
The Load Packer (patented) all enclosed garbage and refuse unit. Compresses loads hydraulically.



Type C12 Body and Model D6 or D7 Hoist. Dumping angle 55°.



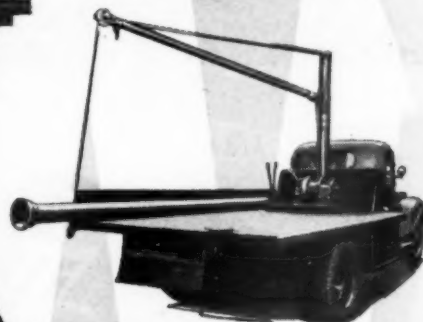
Repair Tower, two sections, insulated platform.



The new Bucket Loader, an all enclosed sanitary refuse disposal unit.



Telescopic boom Crane. Boom radius 8 to 20 feet.



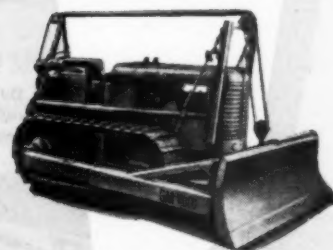
Crane Model 916 with Winch—also available with Dump Body.



Crane Model 4812 for heavy parkway work.



Special Garbage and Rubbish Body on semi-trailer.



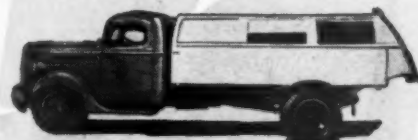
Cable Dozercaster with angling blade.



Street Flushers and Sprinklers.



Type C28 scow and Garbage Body. Steel hinged covers extra equipment.



Type C50 Garbage Body with sliding steel covers on each side.



GAR WOOD INDUSTRIES, INC.

7924 RIOPELLE ST.

DETROIT 11, MICH.

WORLD'S LARGEST MANUFACTURERS OF TRUCK AND TRAILER EQUIPMENT
OTHER PRODUCTS: TANKS • HEATING EQUIPMENT • MOTOR BOATS

IN 1946 FOR THE 9th CONSECUTIVE YEAR



—no Motor Grader without All-Wheel Drive and All-Wheel Steer will be able to match the all-around performance of the "99-M" Power Grader.

Primary and secondary roads took a terrific beating during the war years. Hundreds of thousands of miles are in desperate need of maintenance; other thousands of miles are almost equally in need of widening and resurfacing. No single machine can perform *so many* of these jobs *so well* as the "99-M."

AUSTIN-WESTERN COMPANY • AURORA, ILLINOIS



BUILDERS OF ROAD MACHINERY

Austin Western

SINCE 1859

STANDARD ENGINEERS NOTEBOOK



Compounded lubricant prevents gear scoring

Many operators of automotive equipment have eliminated transmission and differential trouble by switching to RPM Gear Lubricant (Compounded). It is recommended for all transmissions and all conventional differentials. (RPM Hypoid Lubricant should be used in hypoid differentials.)

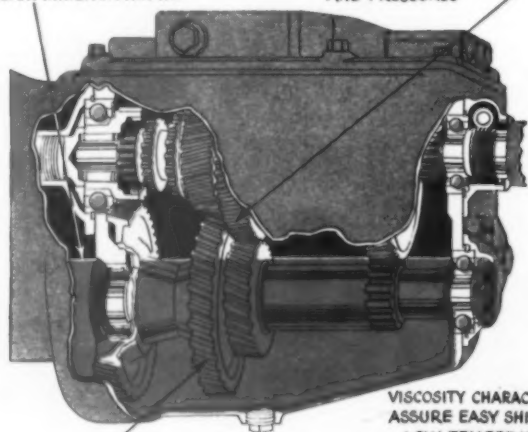
The compounds in RPM Gear Lubricant assure that a tough, oily film will remain on gears when pressure and heat become excessive. A highly effective foam inhibitor prevents retention of air in lubricant, poor distribution and "boiling up" to cause leaks.

RPM Gear Lubricant (Compounded) is non-corrosive. It comes in four grades: SAE 80, 90, 140, 250.

For complete information about automotive drive gears and their lubricants, write for the new, free booklet: "The Lubrication of Automotive Gears."

RPM GEAR LUBRICANT (COMPOUNDED)
CONTAINS THE MOST EFFECTIVE
FOAM INHIBITOR KNOWN

RPM GEAR LUBRICANT (COMPOUNDED)
RESISTS HIGH GEAR TEMPERATURES
AND PRESSURES

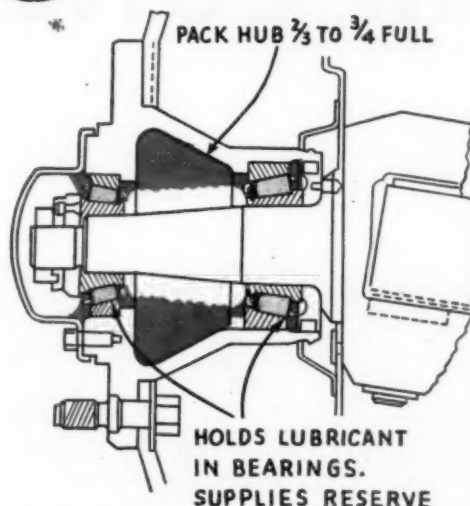


COMPOUNDS FORM PROTECTIVE
ANTI-SCORE PROPERTIES ON GEAR TEETH

RPM GEAR LUBRICANT (COMPOUNDED)
IS FOR ALL AUTOMOTIVE DRIVE GEARS
EXCEPT HYPOIDS

VISCOSITY CHARACTERISTICS
ASSURE EASY SHIFTING AT
LOW TEMPERATURES

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PACK HUB $\frac{2}{3}$ TO $\frac{3}{4}$ FULL

HOLDS LUBRICANT
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SUPPLIES RESERVE

Wheel bearings last with heat-resistant grease

Because RPM Wheel Bearing Grease absorbs the countless shocks on wheel bearings, and stays put in extreme temperatures, it will prolong the life of properly adjusted wheel bearings.

RPM Wheel Bearing Grease is specially made for wheel bearings — both the roller type and the ball type. It will not throw out and melt unduly even in hot weather. In any weather it feeds in the proper amounts onto all parts of bearings providing a uniform, tough lubricant film. The resiliency of this film reduces vibration that might rack wheel bearings and steering gear assemblies.

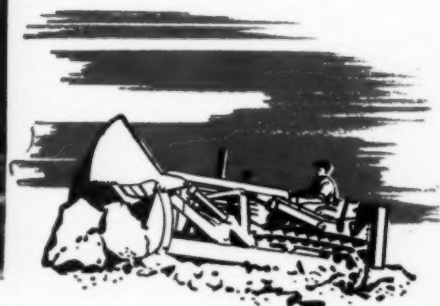
Water resistant, RPM Wheel Bearing Grease helps bearing seals keep out moisture. It seals out grit and dust, too.

For complete information, write for the free booklets, "How To Service and Lubricate Wheel Bearings." There's one for heavy-duty trucks and trailers and one for light equipment.

FOR EVERY JOB A **STANDARD OF CALIFORNIA** TEST-PROVED PRODUCT



Grinding splines of transmission shaft to .001 tolerances in the Oliver "Cletrac" Plant.



We're not tolerant of tolerances!

In fact, we're very exacting! For example, all splines of transmission shafts on Oliver "Cletrac" crawler tractors are ground to a tolerance of .001—insuring true running and easy shifting of gears.

These close tolerances—the precision fits so necessary for smooth, quiet operation—are a primary essential of every operation in the

Oliver "Cletrac" plant. And those tolerances are carefully checked by the most modern testing devices to guarantee the maintenance of the outstanding quality that characterizes every Oliver "Cletrac" tractor.

Materials, design and workmanship are all based on one standard—the built-in quality that assures years of dependable, economical service.

Maintenance of that standard enables your Oliver "Cletrac" dealer to offer you the finest in crawler tractors—for your every need.

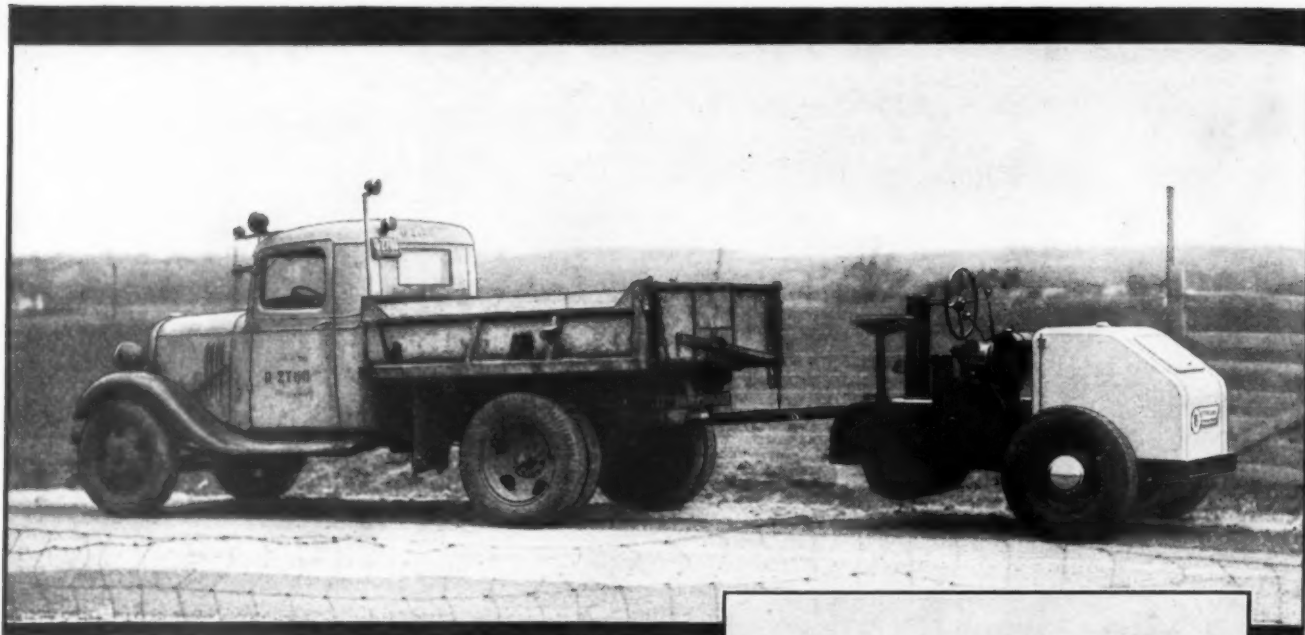
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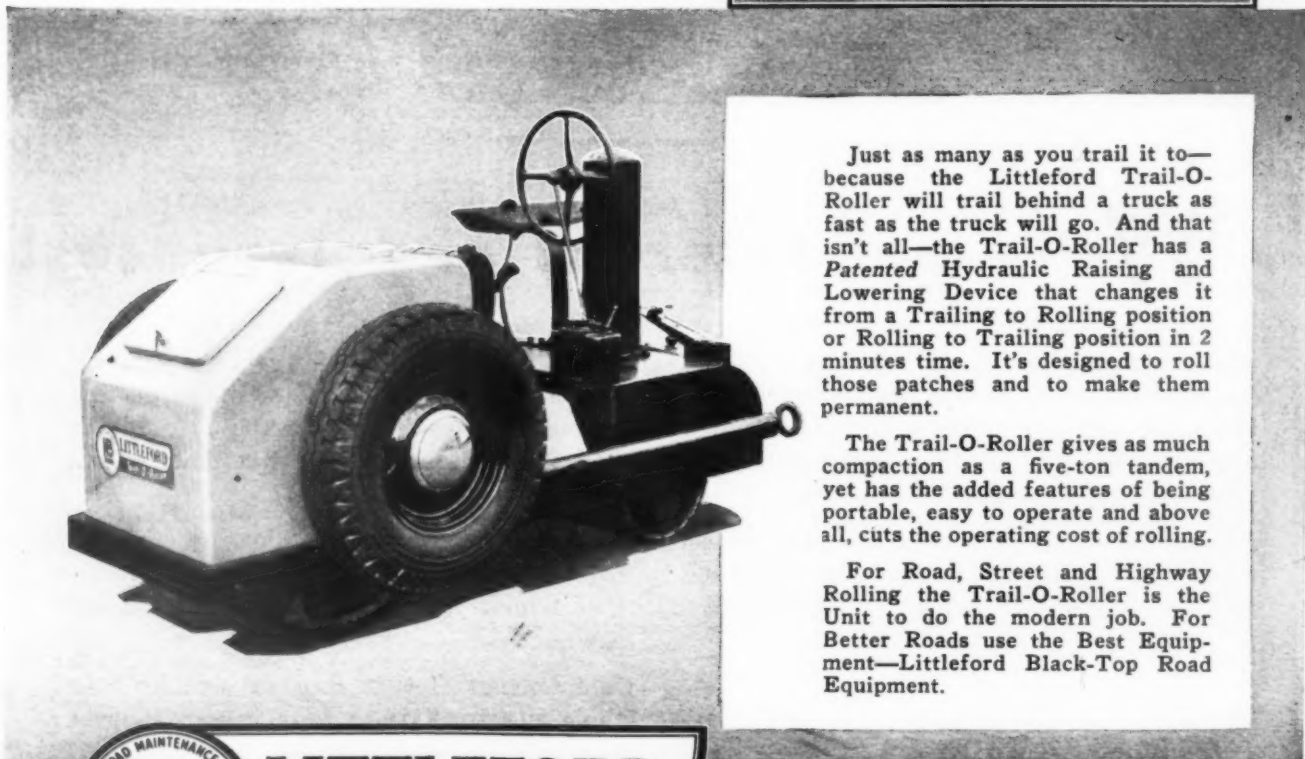
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TRAXCAVATORS are built in sizes for every job and purpose, with bucket capacities from $\frac{1}{2}$ to $2\frac{1}{2}$ cubic yards. Bulldozer blade and other handy attachments are also available to further the usefulness of these machines. Your TRACKSON-"Caterpillar" dealer will gladly show you why it pays to TRAXCAVATE! See him today, or write for the details to TRACKSON COMPANY, Dept. RS-346, Milwaukee 1, Wisconsin.

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The know-how and experience that form the background for Hercules design engineering and precision manufacturing methods can make any hauling and dumping job profitable. We'd like to show you the facts . . . then you be the judge. Address inquiries to Dept. I.



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FAR AHEAD OF THE FIELD

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Contractors now using "AIR PLUS" Compressors on thousands of jobs will tell you that their smoother performance and abundant air supply, obtained with less demand on engine and compressor and proportionate savings in both fuel and upkeep, have made pre-war engineered compressors completely out-of-date.

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"SPEEDLINE"
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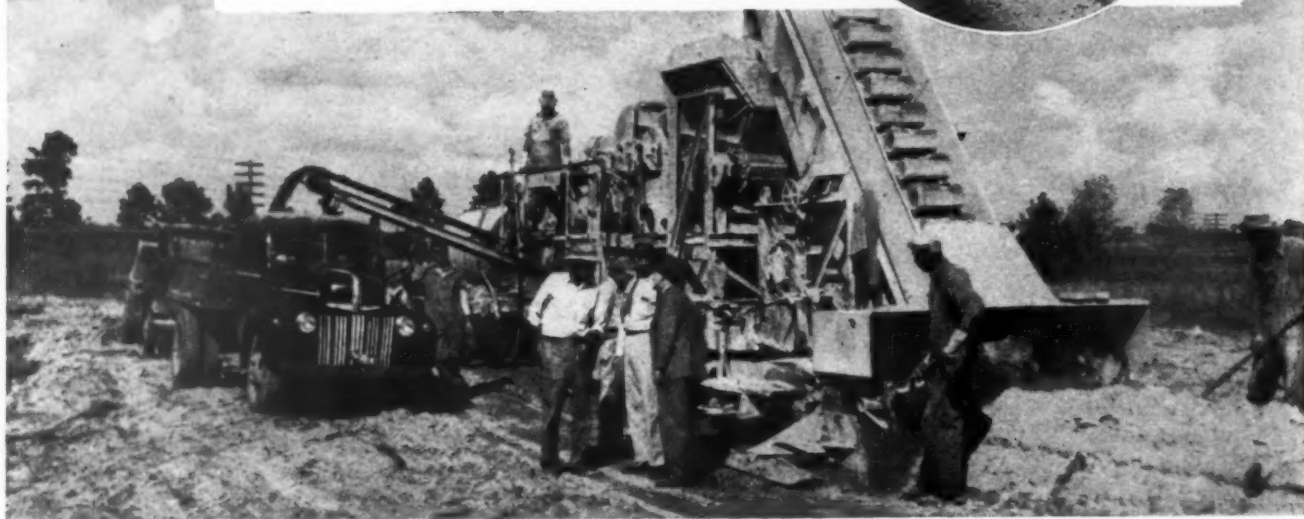
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with **Gulf Lubricants and Fuels**"

says Superintendent M. M. Pace of W. L. Cobb, Inc.*

* W. L. Cobb, Inc., Decatur, Georgia, is the contractor on this million dollar highway project in Troup and Coweta Counties, Georgia. The job involves two miles of new construction, forty miles of widening, and three new bridges. This contractor operates its own quarry, crusher, and asphalt plant.



"A SIZABLE SHARE OF THE CREDIT for our fast progress and low costs on this road job is due to Gulf lubricants and fuels," says Superintendent M. M. Pace of W. L. Cobb, Inc.* "With Gulf products we get efficient, dependable performance from every unit of equipment, and rock-bottom maintenance expense."

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The helpful counsel of a Gulf Lubrication Service Engineer—and the Gulf line of quality lubricants and fuels—are available to you through 1200 warehouses located in 30 states from Maine to New Mexico. Write, wire, or phone your nearest Gulf office.



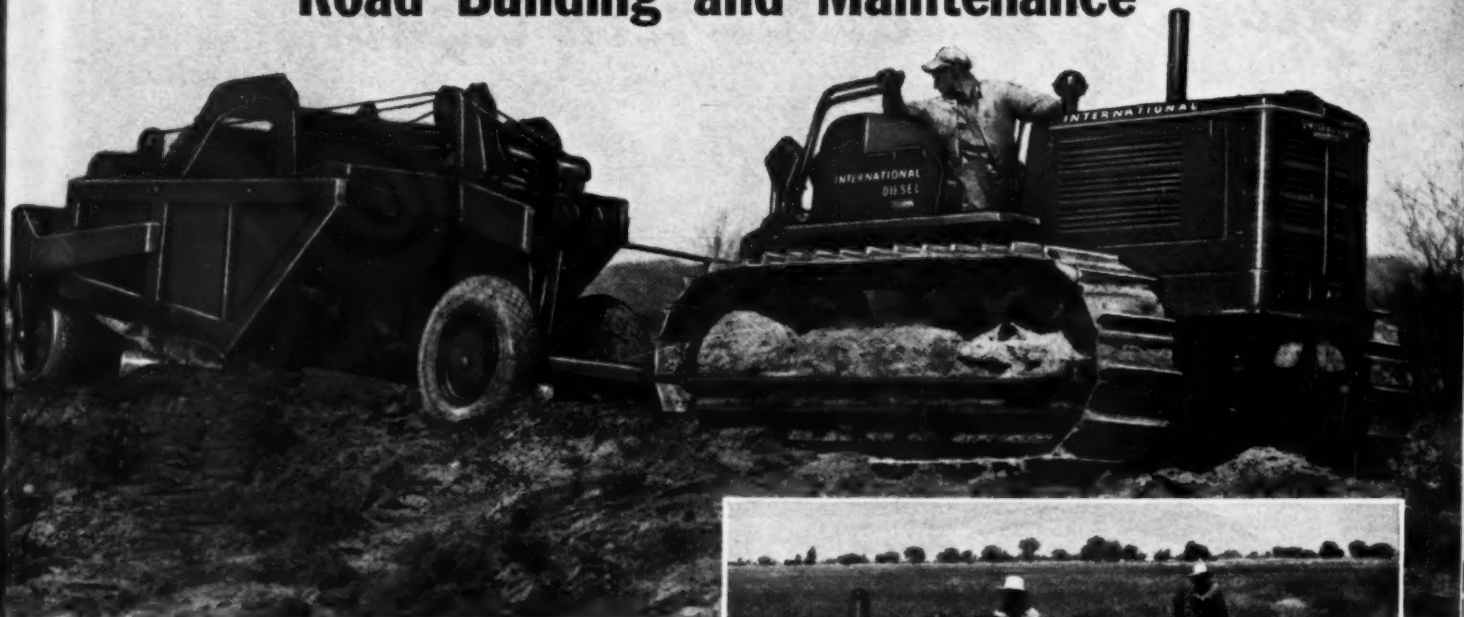
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INTERNATIONAL TRACTORS

Bring Full-Diesel Economy to Road Building and Maintenance



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International Diesels are *full-Diesel* in every respect. They operate at new low cost for fuel because of advanced design fuel injection, controlled by instant-acting governors which meter out fuel in accordance with load variations. That's why Internationals are able to hang on under heavy overloading and develop great lugging ability at the drawbar.

Rugged construction gives Internationals their ability to stand up under severe punishment. Maintenance costs stay at a minimum for the same reason. Crankshafts are Tocco-hardened, crankshaft bearings are of steel-backed replaceable heavy-duty type, transmissions use ball bearings generously, cylinders are of heat-



The TD-14 TracTractor (upper picture) handles this heavy scraper easily at lowest cost for fuel and maintenance. "It talks to you when you hit tough going and keeps on going with a steady, even pull," says the operator of the ID-6, on the maintenance job shown in the smaller picture.

treated alloy steel and replaceable, and the service accessibility of every part is unexcelled.

These are but a few of the reasons why International Tractors effect new economies in highway building and road maintenance. Ask the International Industrial Power Distributor near you to demonstrate them now.

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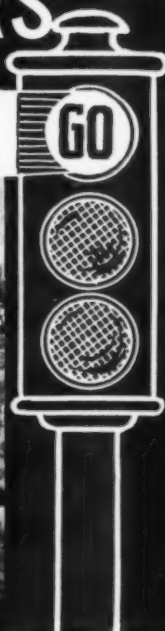
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Industrial Power

Buckeye✓ R-B FINEGRADERS

Give the paver a green light!



Above — Finegrader equipped with overpass permits use of roadway for access to paver. Truck going over Finegrader has load of forms being moved ahead.

They "up" profit on every contract. Check with your nearest Buckeye dealer or write for Buckeye R-B Finegrader Bulletin.

The Buckeye R-B Finegrader is set at the exact road cross section. The pickaxe action loosens extra material left by rough grading. The cutting element leaves undisturbed the hard, compact base below the theoretical grade. Low spots are automatically filled.

The Buckeye R-B Finegrader prepares subgrade accurately in one operation. Under most conditions, it can prepare enough subgrade in 5 or 6 hours to keep the paver busy for 8 or 9 hours. Besides keeping subgrade preparation 'way out in front of the paver, it offers the following advantages to contractors on street, highway and airport jobs:

- ✓ Eliminates need for accurate rough grading.
- ✓ Keeps subgrade accurately at finegrade line.
- ✓ Establishes finegrade to the exact cross section.
- ✓ Operated by one man or one man and helper.
- ✓ Prepares subgrade so accurately loss of yield can be cut to 1% or less.
- ✓ Insures against excessive liability through thin cores.
- ✓ Removes extra dirt left by rough grading.
- ✓ Deposits extra dirt on either or both shoulders, cutting cost of shoulder finishing.
- ✓ Operates efficiently under any soil conditions from sticky gumbo to rock laden top soil.

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FINDLAY, OHIO

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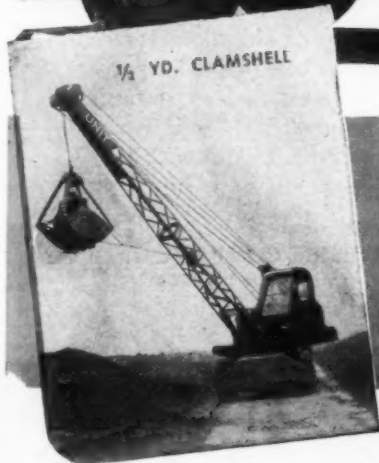
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International Truck Service is supplied by a national network of International Truck Dealers and

by International Branches—the nation's largest company-owned truck-service organization. It is available for trucks of all makes and models.

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INTERNATIONAL Trucks

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YOU CAN USE the extra power of Thor Paving Breakers to do many *different* jobs. As hard-hitting demolition tools they break concrete, rock and ice; cut asphalt; tamp dirt; dig clay and hard pan. Used with Sheeting Driver attachment, they quickly drive wood or steel sheeting as thick as 3 inches. Another simple change of the front head and they become heavy-duty Spike Drivers.

EXTRA POWER Speeds the Work

On *every* job, Thor Breakers are bonus makers. Thor's exclusive short-travel, tubular valve gets more work from *all* the air to drive a reversible, block-type piston in harder blows. Air cushioning of the piston in the cylinder—plus perfect timing and balance—provide smooth operation for easy handling. Air vents in the sturdy back head keep the handle remarkably cool. Rugged construction means long-life and low maintenance cost. You can get these benefits on your own jobs now . . . ask your nearby Thor distributor.

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Unobstructed full-length-and-width door openings—steep, smooth, quick-shedding hopper sides—and finger-tip, air-operated dumping controls.



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Distribution of payload, large tires and double reduction planetary drive axle assure good flotation and traction for tough hauls.

● On this relocation of a Pennsylvania State Highway between Monaca and Aliquippa, Euclids moved approximately 900,000 cu. yds. of heavy clay and rock on long hauls which averaged 3 miles from shovel to dumping area.

In addition to 8 of their own Bottom-Dumps, S. J. Groves & Sons Co. of Minneapolis used 37 other Bottom-Dumps and 8 Rear-Dump EUCLIDS to haul a large part of the total excavation on this project.

Unusual maneuverability of Bottom-Dump EUCLIDS in the narrow working areas on this job was one of the important advantages of this equipment. Another was the rugged simplicity of the Euclids which enabled them to take this tough job in stride day in and day out.

These and other advantages have earned for Euclids their reputation for lower hauling costs. May we send you the proof?

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CLEVELAND 17, OHIO

EUCLID

**SELF-POWERED
HAULING EQUIPMENT**
For EARTH · ROCK · COAL · ORE



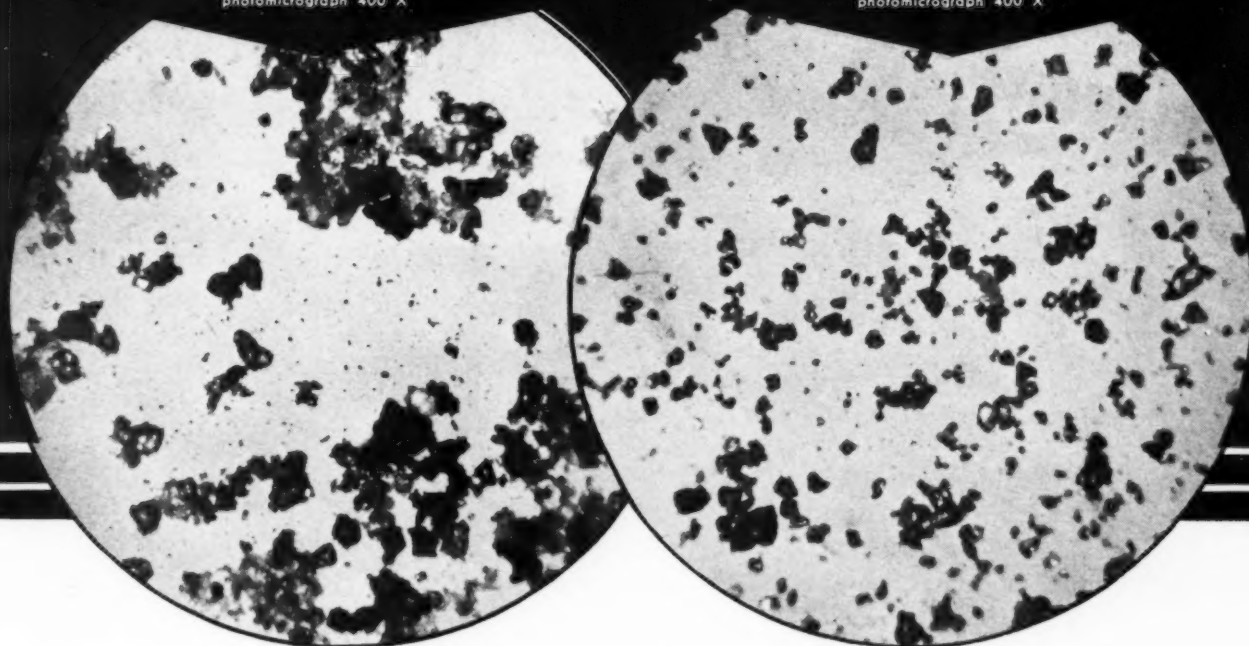
HERE IS WHAT'S BEHIND TODAY'S NEW CONCRETE STANDARDS

If you were to place a little Portland cement in water and look at it through a microscope you would see that the particles **CLUMP** together something like this, resulting in: (1) incomplete wetting of the particles (2) trapping of mixing water in the clumps.

photomicrograph 400 X

When Pozzolith, (Cement Dispersion) is added, the cement particles **DISPERSE** or **SEPARATE** like this, resulting in: (1) more complete wetting (hydration) of the particles, thereby putting more of the cement to work (2) release of the entrapped water, thereby reducing the amount of mixing water required.

photomicrograph 400 X



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LIKE many other products, concrete has been improved greatly in recent years as the result of technologic progress. The outstanding development in concrete — cement dispersion — has made possible up to 500% increase in durability.

This important increase in durability is produced with these great advantages: (1) higher strength (2) easier placing even though water is reduced up to 15% (3) less bleeding — up to 50-60%. These results have been proved in millions of yards of concrete and confirmed by the Nation's top testing authority.

For detailed information on the advantages of cement dispersion, write for information and Pozzolith folder . . . today.

In addition to providing these new concrete standards, cement dispersion effects reductions in initial and long-term costs.

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One Shot Spreading

Fast—Accurate—Low Cost

AIRPORTS



HIGHWAYS



With a Buckeye Material Spreader you can lay an even course of any material from sand to crushed stone in a "single pass." There's no need for raking or brooming. There are no patches to go over; edges to clean up; or low spots to fill.

Width of strips and depth of material are easily controlled. Strip can be spread tapered—thick at one side and thin at the other—or uniformly all the way across. The uniform flow of material is controlled by the spirally fluted feed roll which keeps a positive grip on the material, discharging it evenly in the desired quantities as the truck moves along. Any material—whether wet, dry or

sticky—can be spread with absolute uniformity from a trickle to $1\frac{1}{2}$ " thicknesses (up to 6" with "Strike-Off" Attachment).

The Buckeye Material Spreader is a complete unit, not just an attachment for a truck. It rolls on its own dual rubber tires (steel wheels optional), and feed roll is transmission driven with adjustments for varying speeds. Users report savings of from 30% to 50% on material; accuracy within 2%; and tremendous savings in time.

Send for the Buckeye Spreader Bulletin today, and learn how you can increase your profits on highway and airport jobs.

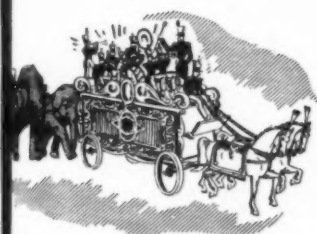
BUCKEYE TRACTION DITCHER COMPANY
FINDLAY, OHIO



Buckeye

CONVERTIBLE SHOVELS—BULLDOZERS—ROAD WIDENERS
TRENCHERS—MATERIAL SPREADERS—R-B FINEGRADERS

TRUCKS *that "Double in Brass!"*



In the circus, a hostler who dresses up and plays a horn in the parade, or an equestrian who takes a turn on the flying trapeze, is said to "double in brass."

Versatility—ability to do many jobs well, is a big asset in trucks too. The Marmon-Herrington *All-Wheel-Drive* Converted Fords, shown here, certainly "double in brass." They drive snow plows in winter, do grading and general repair work in the spring, and operate as tank trucks for spreading road tar and oil in the summer. They are the latest additions to the fleet of similar units operated by the State of Maine.

No other trucks, at the price, have the stamina, the speed and the sure-footed traction to do the snow removal job so fast and so economically. No others can operate so well, so early in the spring on soft roads, haul full loads through loose sand, dirt or gravel, or climb grades as steep.

These are the *All-Wheel-Drive* trucks which set standards of design that gave allied armies their outstanding cross-country performance in the war—the trucks that have done so much to keep vital arteries of transportation at home in year-around service.

More Marmon-Herrington *All-Wheel-Drives* will be available soon. Better get your order in line for early delivery.

LET'S FINISH THE JOB • BUY MORE BONDS

MARMON-HERRINGTON

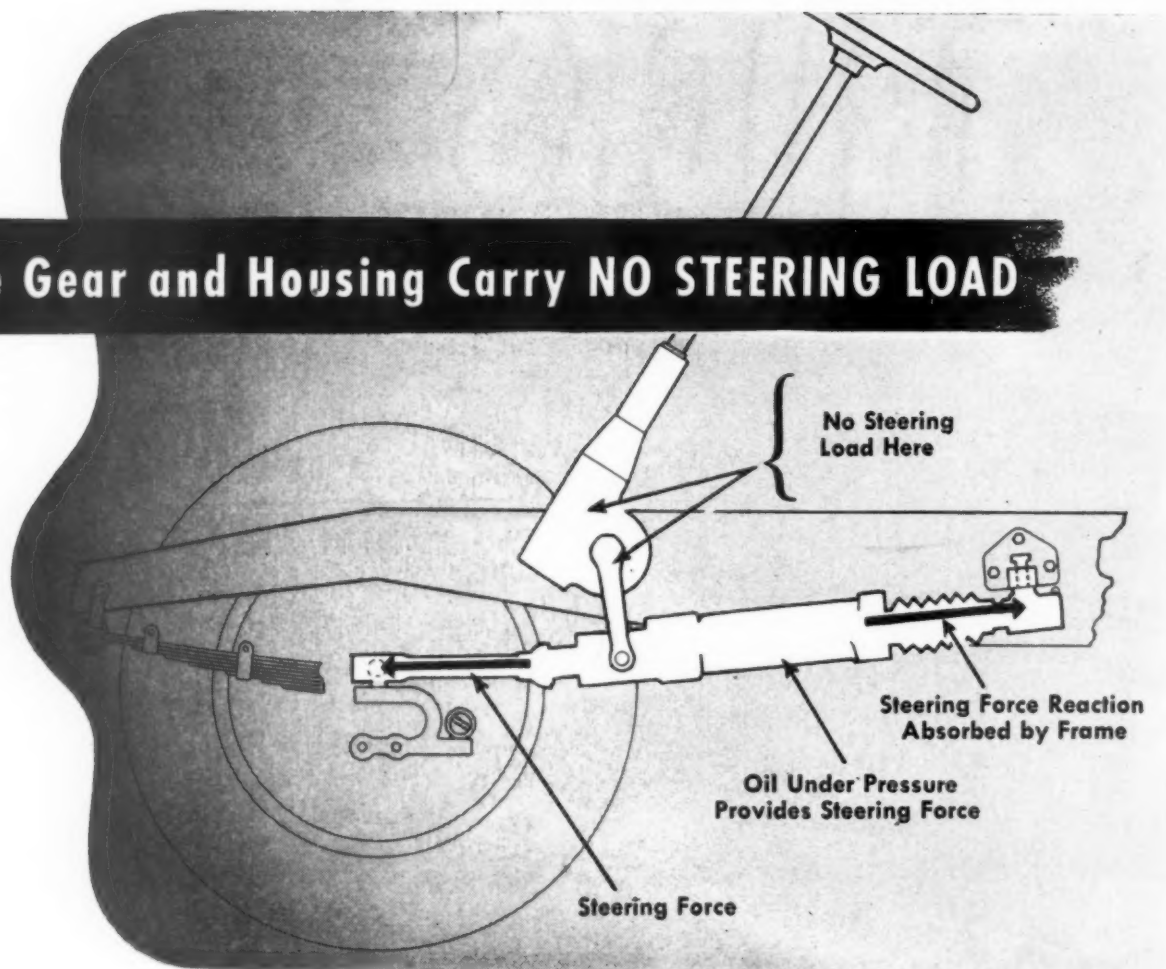


All-Wheel-Drive TRUCKS

MARMON-HERRINGTON CO., Inc., INDIANAPOLIS 7, INDIANA

Cable Address: MARTON

The Gear and Housing Carry NO STEERING LOAD



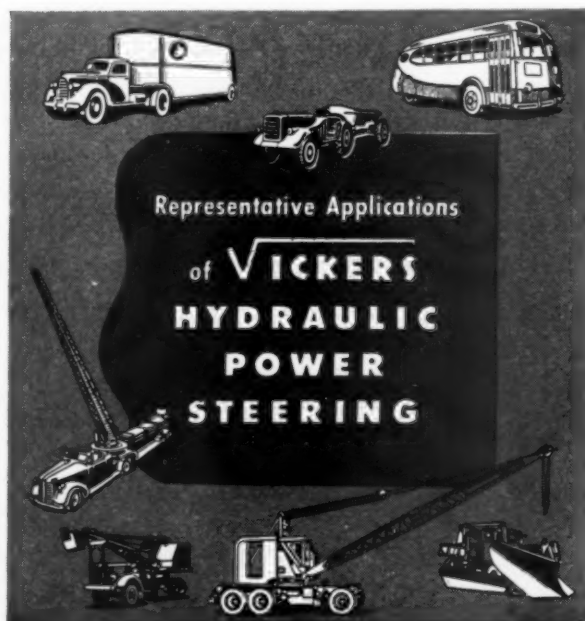
With **VICKERS** **HYDRAULIC POWER STEERING**

Neither steering load nor road shock can reach the steering gear and housing when Vickers Hydraulic Power Steering is used. All the steering load is carried by the hydraulic cylinder, and road shocks are transmitted to the frame. The Vickers booster unit is controlled by the pitman arm and actuates the drag link directly. Direct application of power assures protection against wear or failure in the steering gear proper—makes it possible to use a lighter, more economical gear and housing with complete safety.

There are many other advantages of effortless Vickers Hydraulic Power Steering. Ask for Bulletin 44-30 which contains complete information.

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FREE!
to
engineers and
contractors



This new book contains complete
data on American Welded Wire
Fabric for concrete reinforcement

In this 178-page book you will find information on the most common uses of welded wire fabric reinforcement in all types of concrete construction. For instance: a description of the fabric and its advantages—its uses in general building construction—precast concrete units—reinforced concrete pipe—concrete pavements—airport runways—tables and general information—miscellaneous data.

It tells why millions of square feet of American Welded Wire Fabric Reinforcement have been used in the world's outstanding buildings. There are pictures of the buildings, a group whose names make up the "Social Register" of modern architecture.

THIS superior concrete reinforcement—consisting of closely spaced cold drawn wires of high yield-point steel, prefabricated by electric welding—fortifies the concrete slab against shocks, strain and stresses in all directions. It is easily handled, quickly installed, lies flat and stays in place. Many architects have learned by experience that U·S·S American Welded Wire Fabric Reinforcement is not only eminently efficient, but—since it saves on material cost and construction time—unusually economical.

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Details about Duraplastic cement are summarized in a pamphlet sent on request. Write to Universal Atlas Cement Company (United States Steel Corporation Subsidiary), Chrysler Building, New York 17, N. Y.

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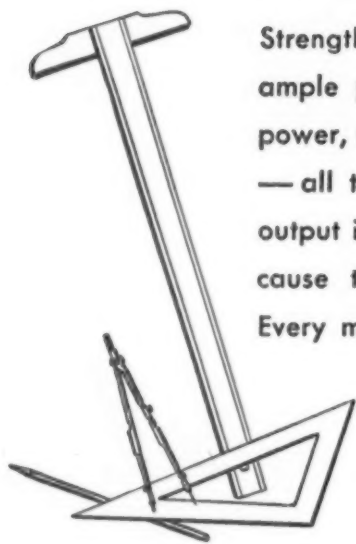
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The Last Word in Asphalt Mixing and Paving

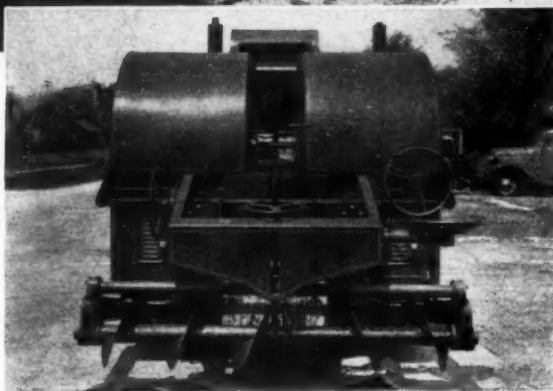


A Complete Traveling Asphalt Mixer and Paver

Engineered and built by America's oldest manufacturers of asphalt mixing equipment, the H & B MOTO-PAVER has been designed to meet the present day need for a highly flexible, mobile and efficient traveling mixer and paver in one self-contained, self-propelled unit.

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Mounted on pneumatic tires, the MOTO-PAVER is powered by two gasoline engines—one driving the mixer and related units, the other driving the machine along the road. Paving speed is from 4 to 50 feet per minute, road speed up to 18 miles per hour. Mixing



capacity is 100 to 120 tons per hour. The MOTO-PAVER will handle all but the highest types of bituminous concrete.

Especially suitable for resurfacing trunk roads and streets of smaller municipalities, the MOTO-PAVER is also an efficient unit for new construction work on roads, streets, airports, parking lots, driveways, etc. Bulletin MP-46, giving complete information and specifications, will be sent on request.

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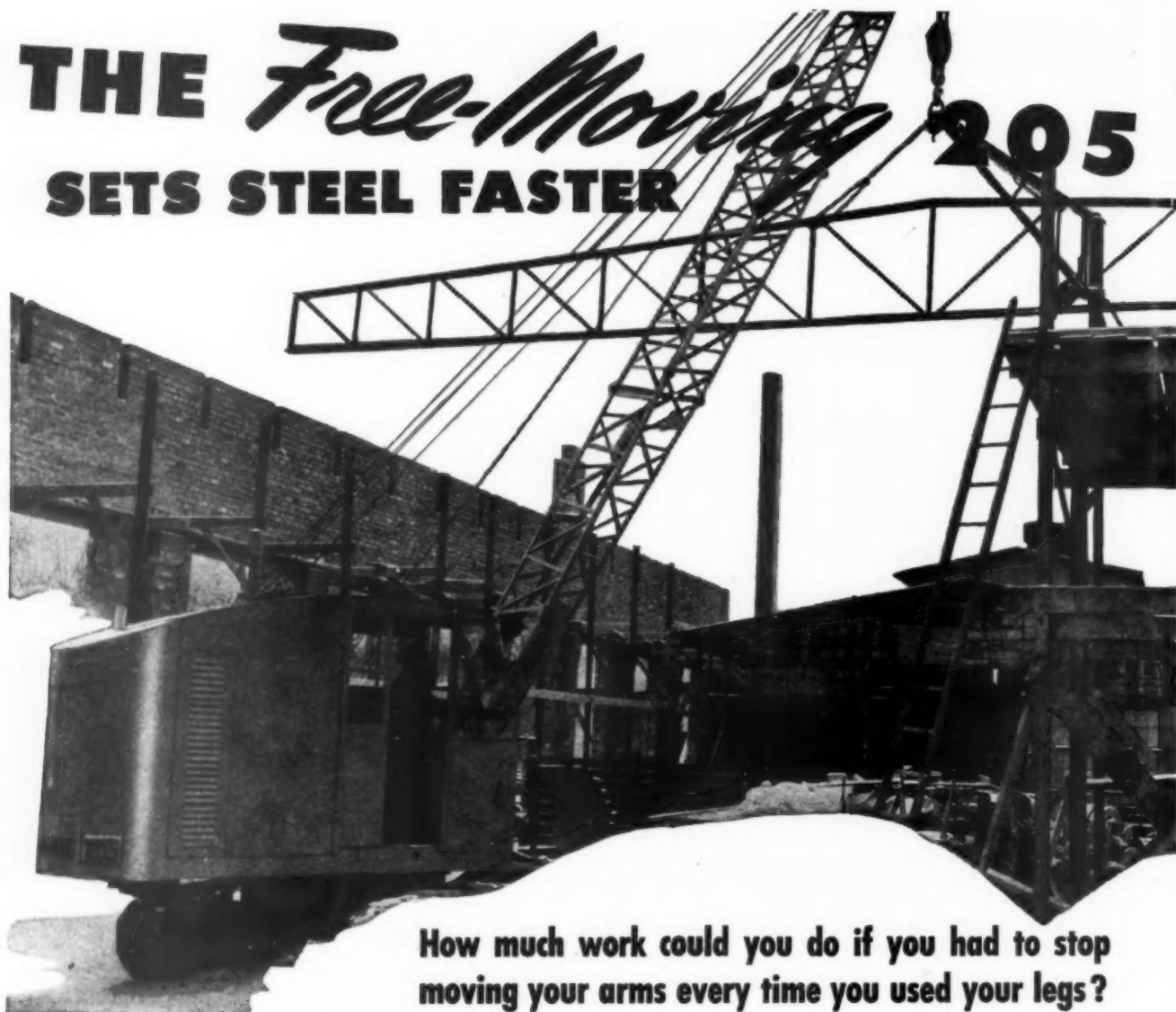
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How much work could you do if you had to stop moving your arms every time you used your legs?

On the Koehring 205, traction is free, independent of all other operations. A separate, individual lever controls forward and reverse travel.

You can swing while you move, raise or lower the boom while you move, hoist while you move. You can travel, swing, hoist, raise or lower the boom—all at the same time. No need to stop any other operation in order to move.

Twenty-five per cent greater maneuverability means greater production per day on any operation, but particularly in setting steel. With the Koehring 205, it's off the storage pile fast, up to where the riveters are waiting in one con-

tinuous, unbroken move. Then inched into place more swiftly, because ALL operations—travel, swing, hoist and boom hoist are available in any desired combination or simultaneously.

205 Crane Facts

Available as Crawler Crane, Truck Crane or One-Man Operated Rubber-Mounted Cruiser Crane.

Lifting Capacities:

10 Crawlers, 16' Shoes: (10' radius, 30' Boom, 75% Rating) 13,800 lbs.

11-5 Crawlers, 24' Shoes: (10' radius, 30' Boom, 75% Rating) 15,500 lbs.

Cruisers: (12' Radius, 30' Boom, 85% Rating) 14,500 lbs.

Truck: (12' Radius, 30' Boom, 85% Rating) 20,000 lbs.

Booms: 30' length standard. Additional segments in 5' and 10' lengths.

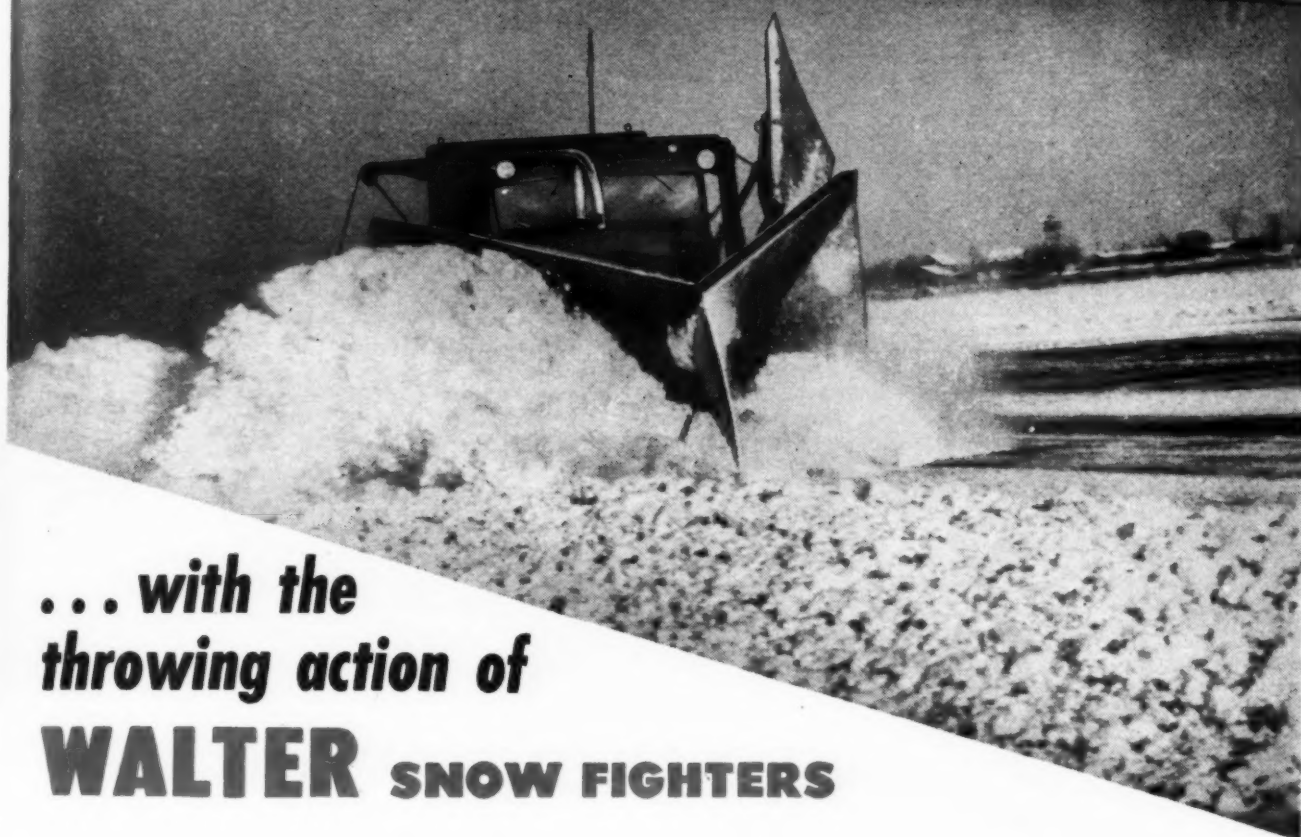
Clutches: Smooth acting inside band type. Power Lowering Device: Optional.



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HEAVY-DUTY CONSTRUCTION EQUIPMENT

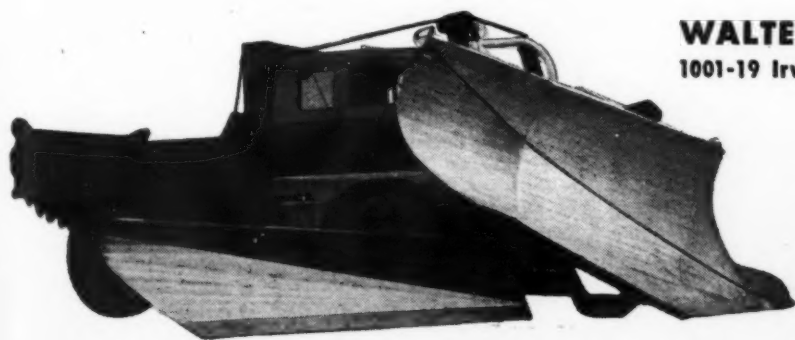
Don't pile it up... **CLEAR IT OUT!**



**... with the
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● Avoid "slow-plowing" methods. They only pile snow higher—make it harder to handle with each successive run. *The right way is to hit snow fast, throw it far—really CLEAR IT OUT!* The way Walter Snow Fighters do on their 20-30 m.p.h. runs that leave less to be re-handled and speed widening out. Clearing more snow per hour, Walter Snow Fighters diminish the danger of frozen ruts and ice—rid main highways of snow faster—get on secondary roads sooner.

Walter Snow Fighters maintain high speeds on snow and ice because their tremendous power is transformed into smooth, positive traction by the exclusive Walter Four Point Positive Drive. Three automatic locking differentials proportion the power to the **FOUR** driving wheels according to the traction of each wheel at any instant. No wheel spinning, consequently there's no dangerous side slipping. Positive traction is but one of the features that make these units Snow Fighters in every respect. Others are described in detailed literature. Write for it.



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Moving or removing earth, rock, aggregate, or any similar material, is easily, efficiently, economically done, with a LINK-BELT SPEEDER "Shovel-Crane." Ample power supply, easy, precision controls and high maneuverability make these machines favorites with the operators; their economy of operation and upkeep, plus their wide range of application, rate them as top-grade profit-makers.

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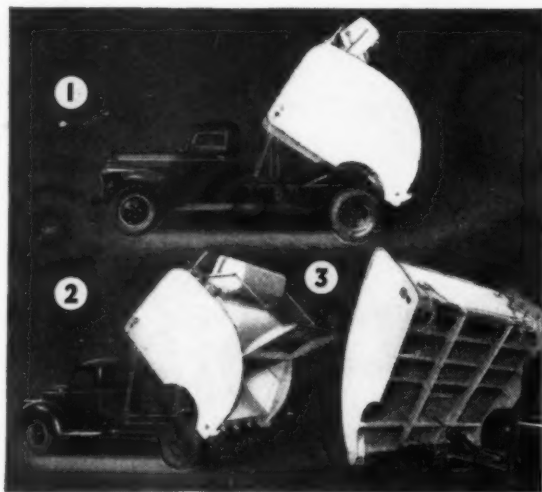
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... takes its place in the famous line of GAR WOOD Municipal Equipment

The Bucket Loader, another Gar Wood achievement, was designed to meet the ever increasing need for an all enclosed, sanitary refuse collection unit to handle wet garbage, ashes, sweepings and other non-compressible refuse.

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Please send Bulletin BL1 which fully describes the new Gar Wood Bucket Loader.

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WORLD'S LARGEST MANUFACTURERS OF TRUCK AND TRAILER EQUIPMENT

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From 3/4 cu. yd. to 40 cu. yds.

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Chrysler Industrial Engines

Power Over 35 Types

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For 150 Manufacturers

Third party endorsement is the greatest factor in any sale. When over 150 manufacturers turn to Chrysler for engines to power their respective equipment covering 35 different applications—there is proof of customer satisfaction.

More important, still, is the fact that these manufacturers depend upon Chrysler Engines to deliver top performance out in the field—on the job—that wins ever increasing patronage.



OUT IN THE FIELD WHERE CLASS TELLS

Chrysler, as a producer of thousands upon thousands of industrial engines each year, is kept abreast of power requirements in every basic application of gasoline horsepower.

A goodness and inherent quality, therefore, is to be found in Chrysler Industrial Engines resulting from the close cooperative engineering and requirement analysis offered powered-equipment manufacturers. This assures new performance values to customers.

Versatility — Dependability — Efficiency

Chrysler Industrial Engines have proven their merit in many power applications in the construction field.

In portable welders, for example, they deliver smooth, flexible power—so necessary for the constant idling and top speed requirements in industrial arc welding.

Engine parts subject to wear are Superfinished to a mirror smoothness. This means more work hours at less cost for portable welding equipment powered by Chrysler Industrial Engines.

The performance record of Chrysler Industrial Engines

in tractors, cranes, shovels, draglines, pumps, air compressors, generator sets, and other power applications in construction work, distinguishes them as "Horsepower with a Pedigree."

Mail the coupon today for illustrated catalog showing complete power range.

Attention Dealers: Some desirable Chrysler Industrial Engine territories are available. Write to the Chrysler Industrial Engine Division for complete information.

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Please send the Chrysler Industrial Engine Catalog.

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Condensed Specifications

CAPACITY: 34 cu. ft. plus 10% on 6% grades. Bucket capacity 55 cu. ft.

LOADING SKIP: 118 in. wide. Renewable discharge spout liner.

SKIP HOIST: Hoist drum tapered and spiral machine grooved. Twin Disc clutch. Timken Bearings. 158 sq. in. braking area.

DRUM: MultiFoote Double Cone, Double Compartment. Machined rollers and roller paths. Renewable liners. Rotary discharge and transfer chutes of high carbon steel, renewable wearing plates.

BOOM: Boom 10 in. channels of high carbon steel. Swings, raises and lowers by power. Length 35 ft.

TRACTION: Gear driven. Working speed .6 miles per hr. Travel speed 1.1 miles per hour.

ENGINE: Hercules HXC, piston displacement 779 cu. in. All standard equipment. Power take-off: Twin Disc clutch and a Lovejoy coupling. Diesel power available if desired.

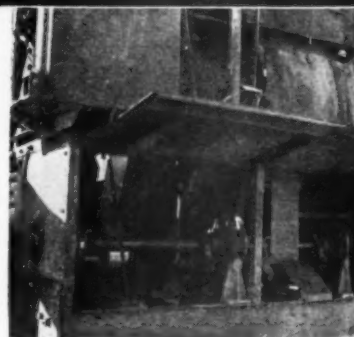
LUBRICATION: All bearings fitted with Alemite-Zerk high pressure grease gun connections.

All the MultiFoote Advantages

A big paver doesn't need to be complicated—look at this simple main drive shaft and clutch assembly! Like the rest of the DuoMix, it is easy to get at, rugged and dependable in operation. Other proved MultiFoote advantages include: Sealed in oil helical-cut-gear power take-off; Timken bearings on all high-speed shafts; MultiFoote Double Cone Drums for thorough mixing; no-pressure water system with large standby tank; wide, solid, fast-charging skip; high, full-visibility operating platform; fast traveling bucket with all mechanism outside; and heavy cross-braced main frame.

New, Exclusive Crawler Design

No "nutcracker" action between treads on this crawler! Exclusive MultiFoote design provides interlocking joints between alloy cast steel tread plates which prevent entry of stones, no matter what position the tread is in. Single drive lugs, on alternate sides of successive treads are completely self-cleaning and have a ball-and-socket action for uniform bearing pressure even on rough ground.



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MULTIFOOTE
Duo Mix
(DUAL DRUM)
**34-E CONCRETE
PAVER**

High Speed • Real Maneuverability
MultiFoote Dependability for Better
Profit Margins on Your Contracts . . .

*H*ERE are a few of the basic facts about the new MultiFoote DuoMix 34-E Concrete Paver—though you'll have to see this simple, rugged machine in action to fully appreciate all the features for smoothness and speed that made the first contractor who tested it insist on buying the pilot model after the trials were completed.

Mechanical delays in the fully automatic mixing cycle have been cut to a minimum—seconds and fractions of seconds clipped from charging, transfer, discharging and dumping add up to extra, profit-making batches on each day's work . . . Main problem on test jobs was to get batch

trucks coming fast enough to give the DuoMix a fair workout. Under heavy work schedules, there has been no time out for alterations or repairs—MultiFoote dependability worthy of the long line of Foote pavers.

Traveling on narrow shoulders and soft grades brings reports that the MultiFoote DuoMix is "light on its feet," and highly maneuverable for a paver of this size. Details on the exclusive new traction are given at left.

Your order should be in soon for early delivery. Check with your MultiFoote Distributor or write direct today for complete information.

THE FOOTE CO., INC.



Three Army-Navy "E"
Awards for The Foote
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34-E

CONCRETE PAVER

ADNUN Black Top Pavers

MULTIFOOTE 27-E

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SINGLE DRUM 34-E



HIT IT HARD

...find out why
**MAINTENANCE
COSTS LESS**

**MARFAK
STAYS PUT**

Hit it as hard as you can, *Marfak* cushions the blow, doesn't splatter — stays in the chassis bearings.

GREASE SPLATTERS

Even a light blow sends ordinary chassis lubricant flying in all directions—leaving parts unprotected.

THIS simple "hammer test" proves that *Texaco Marfak* is super-tough, adhesive and cohesive — stays right where you put it despite heavy loads and hammering shocks. It gives greater protection with fewer applications, makes parts last longer. That's why operators everywhere use *Marfak* to reduce maintenance costs.

To prolong the life of wheel bearings, use *Texaco Marfak Heavy Duty*. It stays in the

bearings despite high speeds, heavy loads and extremes of temperature — sealing out dirt and moisture, sealing itself in, assuring safer braking. No seasonal change is required.

For Texaco Products and Engineering Service, call the nearest of the more than 2300 Texaco distributing plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.



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ROAD

With Tennessee Contractors on 51 Miles of Widening

Eller & Olson and Wolf-Michael were prime contractors on \$1,400,000 modernization project involving concrete base patching, subdrain installation, both penetration and concrete widening strips, and hot-mix topping

US 70 N through central Tennessee was a war casualty for sure. After giving a good account of itself for upward of two decades, the 18-ft. and 20-ft. pavement (asphalt surface on a cement concrete base) became badly worn or damaged under army war maneuvers in training a million men for European combat divisions.

State highway department forces wanted to do a better job than just to spot patch and repair this road, but opinion among individual engineers was divided as to when to patch and when repaving was required. Patching of concrete base being considered a relatively costly procedure in this instance, some engineers felt that a cheaper and better highway would result if patching were held to a mini-

mum and a relatively higher percentage of repair funds put into a heavy hot-mix resurface.

The decision was to widen the existing pavement to 24 ft. throughout, patch the better sections, use 7-5-7 concrete base where repaving was necessary, install side drains where pumping had been encountered, and resurface throughout with bituminous concrete.

Side drains consisted of 6-in. porous concrete pipe laid with open joints in a stone-backfilled trench adjacent to the pavement edge. Careful consideration to the cause of joint pumping resulted in the belief that 90% of the trouble was due to infiltration of surface water into poorly drained subgrade which proper drainage would remedy.

The 51 miles selected for repair was let in two closely adjoining sections, described as follows:

27-Mile Contract

Eller & Olson of Nashville had the first 27 miles east of Nashville. Their job was to patch the concrete, widen with penetration macadam and recap full width with hot mix.

This contractor set up a 27-E paver as a stationary plant and hauled concrete for the patches and smaller replacement areas, using agitator truck bodies of 2 to 3 cu. yd. capacity. The paver was put to normal use for the several more extensive areas of base repaving. Boyer & Johnson subbed the patching.

Drain trenches along the pavement



★ Placing the leveling course on the Eller & Olson project. Here old 20-ft. concrete pavement previously had been reconstructed 24 ft. wide



★ General view of modern 1200-ton-per-hour crushing and screening plant, set up on the Wolf-Michael project by Smith Engineering and Construction Co., Pensacola, Fla. The primary crusher was a 25-40 gyratory self-feeding unit powered by 100 hp. electric motor

★ Showing return conveyor bringing oversize up for a second run through the secondary crusher



★ The 10 x 36 secondary crusher shown in foreground was powered by a 75 hp. motor. Note standby gasoline engine power unit at left

★ (Below): This skid-mounted, portable building shelters a panel board on which are assembled the electric controls needed for any given set-up of crushing or screening equipment



★ (Left): Bin and separating screen assembly included a dust machine, installed originally by the contractor for occasional use in manufacturing agricultural limestone as a by-product



★ (Lower Right): Electric power was furnished by two 440 hp. diesel motors, housed in this mobile enclosed trailer unit for quick and convenient moves between projects in the contractor's extensive southeastern territory



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★ Eller & Olson's trenching plow—
drop blade section bolted at center
of a grader blade

edge were dug mechanically and
stone-backfilled with dump trucks.
However, most of the mileage re-
quired no drains. Shoulder trenches
2-ft. wide for base widening were
first opened up with a rooter, then
plowed out neatly and rapidly to a
depth of 8 in., using a motor grader
having a special plow-shaped drop
section bolted near the blade center
(see photos). This blade left a clean
sidewall in the trench, thus minimiz-
ing "overage" of trench stone. A
trench roller then followed.

"Black base" widening construction
consisted of a 2-ft. wide strip along
either edge, placed in two courses.
The lower course called for 4 in.
(compacted) thickness of crushed
stone, 2½-in. max., which was rolled,
given bituminous penetration and
choked with fine stone. A second
course, similar to the lower or first
course, was then placed, rolled, pen-
etrated, choked and rolled to finished
grade. All aggregate for this con-
tract was taken from a single cen-
trally located quarry.

The hot-mix resurface consisted of
250 lbs. per sq. yd. of binder and 100
lb. per sq. yd. of surface course. Two
spreaders worked in tandem, keeping
close together to effect a hot joint.
Before applying hot-mix the pave-
ment was cleaned with a tow-type
broom.

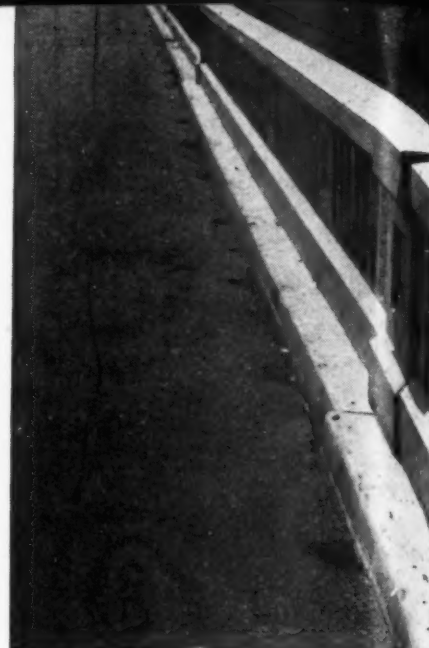
★ Another small detail but important
—properly feathering a load of hot
mix at the ends of resurfaced sections

★ (Left): First course of penetration
stone partly placed in the widening
trench. (Right): Typical turnout in
stone trench, for drainage. This one
occurs at junction with new 24-ft.
base and at end of a cut



★

★



★ What do you do with weep holes in bridge decks that have been resurfaced with asphaltic concrete? Just leave hand-formed openings

★ Wesco Paving Company's modern hot-mix plant of 90-t.-per-hour capacity

More Money for Kentucky's Rural Roads

Governor Willis has been asked by State Highway Commissioner J. Stephen Watkins to include in his budget program a provision that rural roads get at least 20% of funds used for highway purposes. A minimum of \$4,000,000 a year, double the present allotment, exclusive of any federal grants is a part of Commissioner Watkins' request. This request is in connection with the budget which the 1946 General Assembly will adopt for the two-year period beginning July 1, 1946.

★ (Left): 100 hp. diesel power plant operated the dryer and other elements of the hot-mix plant. (Right): The pavers stayed near each other to effect a hot joint

Concrete Widening, Too

Wolf-Michael, of Memphis, was low bidder on the adjoining 23-mile section. Specifications for this job differed somewhat from Eller & Olson's in that the base widening was done with concrete. A 27-E paver was used for the patching and widening, the latter being expedited by use of a specially made wooden spreader box 2 ft. wide by 6 ft. long.

Wolf-Michael's stone production was handled by Smith Engineering

and Construction Co. of Pensacola, Fla., and their hot-mix production by Wesco Paving Co. These two companies set up exceptionally modern equipment for the job as shown in the accompanying photos.

The foregoing projects were carried out under the Tennessee state highway department headquarters and division staff, R. J. Love being division engineer, H. D. Long, division construction engineer, and Clarence Greek and Paul Wyatt resident engr.



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ROADS

★ Spotlight on Safety Problem

The President's Highway Safety Conference to be held in Washington in May promises to be one of the most important events in recent highway history. This meeting has been called as a means of dramatizing the tragedy of death on the highway and spotlighting every known means of reducing them as well as machinery for putting the means into effect.

With Major General Fleming, Federal Works Administrator and well qualified committee chairman heading up the Conference, we are assured that the engineering side of the "3 E's" will get full consideration.

Just what percentage of traffic accidents is traceable to defective or obsolete facilities is a controversial question, and more data should be sought on the subject. We are indebted to Commissioner Miller of New

Jersey for a specific example of the way modern design can save lives. New Jersey made a "before and after" study of accident experience on its multi-lane routes which have been dualized since initial construction. This study covered ten years from 1935 to 1944 and encompassed 48 miles of routes carrying from 13,000 to 41,000 cars per day. Quoting Commissioner Miller: "The study demonstrates conclusively that the fatality rate can be reduced by improved highway design. Dualization has been responsible for the reduction of 42% of the fatality rate; grade separations 37% and the remaining 21% can only be reduced by an increase in education and enforcement. As we embark upon our postwar program, the factor of highway safety will become an increasingly important one and should be a part of all of our planning for the future."

★ Alcan Builders Cleared

It was mighty good news to us to read that a Congressional committee has publicly cleared the engineers and builders of the Alcan Highway of any suspicion of fraud or corruption. Rumors and innuendos flew thick and fast all through the war over this controversial 138-million-dollar project, which was conceived in desperation at a time when the Japs had Alaska in their hands but didn't know it, and used finally as access to build airports.

Certainly there was waste on this pell-mell project.

We won't go into the fantastic dual set-up under which the Public Roads Administration and the Army Engineers worked together with overlapping authority and lack of clear statement of policy. But from this editor's two trips over the highway, it was evident that the leaders were doing their best as they saw it. Most of these men today are back at their peacetime jobs, and we know that the statement recently issued by Chairman Robinson of the House Roads Committee was good news to them likewise.

★ Contractors and Research

Highway engineering advances through research. And highway development, speaking more broadly, stems from sound long-range programs and sound planning of projects. By the time a road job reaches the letting stage, the wisdom of the researcher and the planner and the administrator have gone into a fat roll of blue prints which the contractor is given to look over a few days or weeks in advance of the letting date.

Then at that point science becomes art and the contractor pits his individualism, his practical skill and his resources against the caprices of weather, under-surface materials—and labor unions.

How can our contractors tie themselves in more closely with the scientific spirit necessary to modern highways? This line of thinking was an inevitable one as a result of our six-day attendance at the Highway Research Board and highway officials' meetings at Oklahoma City. The American Road Builders' Association with its equipment manufacturer and contractor as well as engineer membership, of course, is in a unique position to tie the whole field

together. And there is the Joint Cooperative Committee—AASHO-AGC. But we are glad to note that still another strong link exists. That is the relationship between the Associated General Contractors and the Highway Research Board. D. W. Winkelman, recently chairman of the Associated General Contractors' Highway Division, has been appointed chairman of the Board's newly constituted committee on "Economics of Highway Construction and Maintenance Methods."

The point of view of the contractor is needed in devising and carrying out research. To cite one of many every-day field problems, why split hairs in the theoretical design of a dowel assembly or load transfer device when an equally important consideration is how easy or difficult it may be to work the concrete properly around the joint on a fast-moving job? There are also the broader aspects of road job planning and management. Every highway contractor with an eye to the future of his industry should offer his help in making a success of this new committee activity.

AASHO Meeting Report

State highway leaders must place greater emphasis on administration and planning, cooperation with counties and cities, traffic and other use functions, delegates heard at Oklahoma City convention Jan. 29-Feb. 1

CHARGING that the science of management has failed to keep pace with technical progress, and that many states must overhaul and revitalize obsolete highway organizations, PRA Commissioner Thos. H. MacDonald counseled road leaders at the American Association of State Highway Officials Annual Meeting to give greater consideration to the new administrative responsibilities they face in this postwar world. [His significant address was published more fully in February **ROADS AND STREETS**.]

In similar vein retiring president Herman A. MacDonald put stress on the difficult role of cooperating with cities and counties, and urged a spirit of fairness and full consideration of urban and rural community needs in the difficult task of cooperating with municipalities and counties under the 1944 highway act.

President MacDonald noted the close relationship in research assured by the Highway Research Correlation Service instituted by the Public Roads Administration and the Highway Research Board. Under this plan the Highway Research Board proposes to act as the agent of the AASHO to organize and administer the service by means of field engineers, committee work and publications. "The war . . . has taught us the necessity of cooperation and quick action," he said.

He also touched on the Association's strenuous efforts to establish uniform legal weight and size restrictions for highway traffic in various states, and took note of the serious bid price situation and attendant delays in awarding a large construction volume. In spite of the need for highways he warned that officials must resist the temptation to award at excessive prices.

The retiring president urged a re-examination of pay scales for engineers, and possible adjustment to match salaries in industry. The AASHO executive committee subsequently authorized a special committee to study this question.

Cooperation Between Agencies

A look ahead in highway legislation was given by Hon. J. W. Robinson, chairman of the U. S. House of Representatives committee on roads. He foresaw no change in present channeling of federal highway funds through the states, which he vigorously championed as the wisest and most efficient method. He urged greatest possible coordination of state, county and urban program within each state, with changes in present relationships when necessary.

The 125 million dollars annually provided for urban highway aid represents about \$1.70 per capita, or over one-third as much as the cities themselves provided in 1940. Combined funds should help do a real job of eliminating the overwhelming urban congestion, he ventured, but further federal legislation may be needed if the amount is insufficient.

The success of the urban and secondary program is completely dependent on cooperation between all agencies, warned the Congressman. "This applies to planning, project selection, plans preparation and super-

vision of construction. Already in a number of states we have reassuring evidence of such cooperation. In other states the indications are not so positive. Functions of the state highway departments have been greatly broadened but success depends on how the departments discharge their functions."

Hoffman Heads AASHO

M. J. Hoffman, commissioner of highways, Minnesota, succeeded Herman A. MacDonald of Massachusetts as president. C. W. Phillips, Tennessee, was elected first vice-president; regional vice-presidents: W. W. Polk of Illinois (reelected); Spencer Miller, Jr., N. J.; H. B. Henderlite, La.; R. H. Leavitt, Utah.

Administrative Problems

An innovation was the substitution of panel discussions in place of formal papers at two half-day sessions, devoted respectively to administrative and engineering problems anticipated under the Federal Highway Act of 1944.

The administrative session was led by M. J. Hoffman, assisted by G. T. McCoy (Calif.); H. S. Fairbank (PRA), W. G. Scott (Nebraska); C. W. Phillips (Tenn.); Spencer Miller Jr. (N. J.); W. V. Baise (N. C.); and C. E. Vogelgesang (Ind.). Discussion was given to matters pertaining to the establishment of the Interstate and secondary systems and urban projects, and to plants preparation, right-of-way, rail-highway separations, labor and price problems, and personnel.

Interstate System. What routes should be included in the National System of Interstate Highways? A tentative system had been selected and will be put up for formal state approval soon. After considerable delay some 45,000 miles of routes were recommended in the states, of which 37,000 miles are included in the tentative system recommended. Differences of judgment on routes were settled in conferences. All routes se-



M. J. Hoffman

lected for this system will automatically become Federal-aid routes without taking from presently allocated F. A. mileages.

The aim in developing this Interstate system has been kept long-range, said Mr. Fairbank. The committee looked far ahead at times to create a national network connecting urban centers but also having local importance. Greatest service to the most population was the criterion in route selection. Modified design standards were adopted last summer after wide discussion. [See Nov., 1945, R&S.] There is no intention of developing this system all at once to the neglect of other roads.

Secondary F. A. Roads. What constitutes a principal secondary highway and how should the states proceed in selecting their secondary Federal-aid systems? This question was asked of G. E. Vogelgesang, who stated Indiana's procedure which was to select county and other non-primary roads having the most traffic, considering also local service requirements. Tennessee's method was to select, through a committee of the county highway association, 2500 miles of eligible routes on the state system and 3400 miles, or about 50% of the county roads. Utah state officials asked the counties to designate the least mileage that would bring the most traffic to primary roads or into cities; here traffic was less of a factor, economic and social needs governing.

Some states are having difficulty in matching federal funds for secondary F. A. projects, said W. S. Scott of Nebraska. California has a bill in the legislature to appropriate \$12,000,000 for matching federal funds, 87½% to be spent on county highways.

Force-Account construction policy on federal-aid secondaries was brought up. Approval of force-account will be considered by PRA where the state recommends it. The reasons for requesting should be embodied in plans submitted to PRA, along with an estimate of quantities and unit prices. [See Feb. R&S for PRA's administrative Memo No. 297 on this matter.]

Urban Highways. How should state allotments for F. A. urban projects be divided between cities within a state? This question is a prime headache to highway departments, which are under great pressure. While the question was not cleared up at this meeting, warning was voiced of the danger of dispersing or frittering funds over too many projects, and the need to fix and "sell" cities on a priority based on urgency. New Jersey's policy, however, is to give each community some

AASHO Awards

To Samuel C. Hadden, consulting engineer, Indianapolis, a certificate of appreciation for his work while president in 1944.

To seven association members of the National Highway Traffic Advisory Committee to the War Department, meritorious citations for patriotic service, presented by Lt. Col. F. M. Kreml, Office of Chief of Transportation. Recipients: Thos. H. MacDonald (chairman), Herman A. MacDonald, S. C. Hadden, J. S. Williamson, Hal H. Hale, Brady Gentry, G. Donald Kennedy.

To 573 veteran state highway and PRA executive employees, meritorious award for 25 years' or more of service.

project each year if possible and get cities to contribute more substantially to the solution of their own problems. Cities must work up long-range plans based on thorough origin-and-destination surveys, and see that each project fits the over-all plan. Survey facts are good ammunition in combatting pressure groups desiring unwarranted projects, said Mr. Miller.

Organization of surveys is the key to success, and data of vital importance can usually be obtained at a cost representing about a tenth of a mile of modern urban development.

The Public Roads Administration is campaigning to "convert" highway engineers everywhere to a greater interest in traffic, believing that planning and location transcend physical design problems in importance and require a higher caliber of ability. Planning is provided for by allocation of 1½ percent of urban F. A. funds under the 1944 act.

Increased traffic capacity and flexibility in handling traffic are required of any city project approved by the New York State Department of Public Works, said Mr. Sells, of that State. New York now has a special planning bureau in recognition of the difficult problems involved in urban traffic planning, and the State expects to develop a master plan for each large city, integrating main routes with civic programs.

Right-of-Way. Delays in clearing up right-of-way problems is a serious problem on urban projects. H. E. Hiltz of PRA said that quick telegraphic approval of such questions is the aim in Washington when personnel shortage has permitted. Full acquisition of r-w is necessary before PRA accepts final plans.

What is the procedure in reimbursing states of right-of-way costs? The states should go ahead and acquire the land, then claim reimbursement from PRA. This item is part of construction and can be partially paid on a progress voucher. Is there possibility of securing r-w payment before project approval? No. But reimbursement after project approval can be expedited by combining engineering, right-of-way and construction in one project agreement.

How can a state without a controlled access law operate in the absence of such a law to prevent roadside encroachment along limited-access projects? State departments not presently backed up by adequate laws were counseled to consult their attorney general and get legislative action.

Consulting Engineers. What is the official attitude on employment of outside engineers? In discussion J. L. Herber of Pennsylvania said that relatively few consultants have the specialized experience and organization needed on complex urban highway plans. Various policies are followed by the states in receiving bids from engineers for plans and surveys. Six different methods, none requiring direct competition, are permitted by PRA, which expects only a "reasonable" competition for this work. In Pennsylvania, for example, fees are fixed in conference, and Kentucky asks for lump-sum bids.

At the design panel meeting the question was raised as to whether it wouldn't be better policy to use consultants only on special occasions and to attract a larger, more able state engineering staff by paying higher salaries.

Rail-highway grade separation projects: How shall benefits to the railway be determined under the 1944 act? This question was not adequately answered, but all agreed that this law here was a "lawyer's paradise," and that, however difficult, the value of the benefits must be estimated, though claims may exceed the 10% of project cost allowed the railroad. Federal-aid funds not earmarked for grade separations may be used on a 50-50 matching basis for such projects.

Vehicle Weights. Greater uniformity of weight and length limits for trucks is needed, said O. L. Kipp of Minnesota. The AASHO Committee on Highway Transport has balloted the states for approval of uniform limitations. Manufacturers and operators are to be asked to approve. These include 102 in. max. width of trucks and buses; 35 ft. length for single-axle trucks; 40 ft. for 3-axle

busses; 50 ft. for tractor-semitrailer units; 60 ft. for full trailers. Limit on height, 12 ft.; on single axle, 18,000 lb.; on group axle loads, a table of weights based on axle spacing. This table assures progressive increases in total weight as axle spacing increases; 32,000 lb. gross max. for axles 8 ft. apart or less.

Maintenance and Equipment Committee

The great accumulated needs of the highway departments for maintenance equipment was told by Chairman R. H. Baldock at a session of the Association's Committee on Maintenance and Equipment. He voiced concern over the slowness in getting war surplus items transferred. H. M. Wilson of the Surplus Property Administration and other government men present reviewed the history of the surplus property muddle, and described the procedure necessary today in getting equipment. He urged the AASHO to bring pressure to bear in Washington for a different method of handling, if desired, reminding that the great bulk of the billions of dollars' worth of war equipment from dish pans to machine tools must find commercial rather than governmental buyers.

Complaints to date are that long trips must be made to inspect "as is, where is" equipment for sale; that quantity-lots of like units are often too large (500 screwdrivers, for example; states and counties were urged to band together for such parcels); also that contractors are buying all available equipment.

A resolution was adopted urging the Reconversion Administration and the War Assets Corporation director to consider the immediate transfer of the 24,000 units of government-owned construction equipment needed for highway maintenance.

Design Discussion

The panel discussion on design was headed by H. E. Hiltz, PRA, chairman of the Association's Committee on Standards, with H. C. Coons (Mich.), T. E. Stanton (Calif.), O. L. Kipp (Minn.), F. V. Reagel (Mo.), R. H. Baldock (Ore.), M. L. O'Neale (W. Va.), and Raymond Archibald (PRA).

Joint Spacing inevitably led off. A Michigan test road was described by Mr. Coons, who said that the problem in his state isn't expansion but contraction. Pavements laid in summer contract at -20° until the interlock at contraction joints is lost. He recommended no expansion joints in summer construction except at structures; joints at 400-ft. intervals if built after Sept. 15, or at end of the

day's pour, at discretion of the engineer. He contemplates 100-ft. spacing of dummy joints without dowels because construction men don't like them reinforced, but present design calls for $1\frac{1}{4} \times 15$ -in. dowels at 15-in. ctrs. for both expansion and contraction joints.

According to T. E. Stanton, California has decided to eliminate expansion joints as a standard procedure, keeping the 15-ft. spacing of dummies. With improved subgrade he also anticipates elimination of many contraction joints, believing that longer slabs favor less warping. R. H. Baldock said that the AASHO maintenance committee members all are against through or expansion joints. Oregon is eliminating them as a result of research, but keeping the 15-ft. contraction spacing. [A discussion of joints in concrete pavements, held at the Highway Research Board sessions in Oklahoma City, will be reviewed in a forthcoming issue of "Roads and Streets."]

Pavement and Base Thickness. The subject of pavement thickness determination elicited little comment. Michigan practice will henceforth be to reinforce all concrete pavements, using 9 or 10 in. slabs on expressways and heavily traveled primary highways, 7 or 8 in. on lighter primaries, and 6 to 8 in. on secondary routes.

What is the best method of determining the required strength and necessary thickness of base courses? Michigan practice was again cited. Plate bearing tests, involving a piston forced into the subgrade, and mold samples, are used in conjunction with recommendations of soils engineers. Bases in Michigan are made thicker than the formula says, because of heavy frost.

Compaction Needed. O. J. Porter of California said that correlation of laboratory and field data remains a major problem in base design. His state makes a CBR test in place, or a triaxial test on undisturbed samples. He observed that engineers in the middlewest often must forego good subgrade materials due to long haul, and that their task is to get greater compaction of available soils or mixtures in spite of wet climate.

Oregon also uses the CBR test for theoretical determination of base thickness, but adds a liberal safety factor. Twelve to 30 in. of bank-run or quarry-run material is put under flexible type surfaces (heavy logging trucks a local problem).

Bituminous Problems. The continued difficulty with stripping of bituminous binder from aggregates is a major problem, said T. E. Stanton of California. His department has approached

the problem through a study of the abrupt failure of pavements in hot weather involving liquid asphalts. Moisture vapor condensing in the pavement due to a tight seal or cover course has long been suspected of being a serious source of deterioration. Successful tests for condensation have been devised and correlated with the field to obviate this action, it was said.

Aerial Photography. The value of aerial surveys as an aid in location and geometric design was touched on. Michigan contracted last year for a 12-mile relocation in which aerial contour maps (stereo) with 5-ft. intervals are to be used at an expected saving of time and money. Kansas has been employing AAA government photos for preliminary location, and more recently stereoscopic photos scaled 1,000 ft. to the inch, with a 75% saving in the work of staff geologists.

On width and number of traffic lanes, a favorable word was said for the 3-lane highway, which although not in recent favor for safety reasons does have double the traffic capacity of a 2-lane highway.

Construction Costs

Price and cost considerations were given special attention in both the administrative and the design session. A big question is what price index should be used in preparing estimates and awarding contracts. Low bids have been running 30 and 40% above 1942 estimates in some states. In contrast, E. N. Rogers of Alabama reported current letting prices involving $2\frac{1}{2}$ million dollars which were little above 1940; an 18-mile, 8-6-8 concrete pavement job, for example, went for \$2.45 per sq. yd., and some earthwork has gone for 27 cents. In this state 306 bids were received on 15 jobs, one of which attracted 24 bids.

California let 20 million dollars' worth of highway work from November through January, at contract prices 35 to 40% over 1940. Chief problem on urban projects is re-housing of tenants of property condemned for right-of-way.

Bridge bids are expected to continue high, due to lumber and labor, prices now sometimes running 50% higher. Refusal of steel companies to guarantee steel has been a deterring factor, and Alabama has written all contractors that contracts will be adjusted in event of steel increases.

Mr. Baldock reminded delegates that Congress was sold on passing the big postwar program by evidence of the acute need for new highways, lack of which is holding up national progress. Roads bring great benefits, far

(Continued on page 110)

BLADE ANGLES

The right way to operate your motor grader: Principal things an operator (and his boss) should know about blade adjustments



★ When reshaping, set for both cutting and rolling



★ Tilt blade well forward for best maintenance work

Blade Adjustments

THE following boiled down recommendations are included among the helpful hints issued by Caterpillar dealers to owners of their graders:

The blade is the "business end" of any Motor Grader, Blade Grader, or Trailer Patrol and its proper adjustment to suit working conditions is most important. In fact, this largely determines the power required, quantity and quality of work done, and ultimately the life of the machine. As conditions vary with each job, careful observations of results obtained with each adjustment is the best guide, but a discussion of some general principles may be helpful.

The two principal blade adjustments are pitch and angle. Pitch, or tilt, must be such that the blade will cut or mix or scrape as may be desired. The proper blade angle, varies, too, with the type of work being done.

In grading and reshaping, the blade must have proper suction to do actual digging. The blade is so designed that the pitch which gives most effective cutting and also rolling action of the dirt against the moldboard is usually where the cutting edge is vertically below top of moldboard—that is, the line drawn from cutting edge to top of moldboard would be perpendicular to the road. The angle should be just sharp enough so material will roll cleanly off end of blade without pushing an unnecessary amount in front of it.

On maintenance work, best results

are usually obtained by tilting the blade forward at the top to a scraping or dragging position, with the cutting edge portion perpendicular. In some materials, and when maintaining at the higher speeds, it is sometimes better to move the top forward even to a greater scraping or dragging pitch. The blade angle on this work does not need to be as sharp as on grading. The most desirable angle is usually about 20° to 30°. When doing maintenance work, it is also important to keep to a minimum the clearance of circle shoes and blade lift ball joints so the blade will not chatter.

In oil mixing, the required variation in blade adjustments is often greater than any other work. Usually the best results are obtained by using the wide oil mix blade set with the pitch about the same as for grading. This provides the best mixing effect because the blade should always be set to raise the mix readily to the full height of the moldboard and allow it to drop forward. A 45° blade angle will usually be about right for delivering material freely toward the blade end. On certain heeling operations where the mix is crowded heavily into a win-



★ Top or outside end of blade well forward

drow, more effective mixing is obtained by increasing the angle to give a greater force against the windrow.

Good judgment must be used in applying blade pressure. This is especially true on motor graders and power controlled blade graders. Excessive blade pressure is always un-

necessary. Long before the full pressure is applied, the blade is working to its maximum capacity. Likewise, too much cutting pitch defeats the purpose because the blade will begin to ride on the heel.

Watch these important points—pitch, blade angle, and blade pressure.

Nevada Grade Compaction Speeded by Improved Storage Tank Set-up

Contractor cuts loading time to one minute for 2400-gal. trucks on thirsty desert project

GIBBONS and Reed Co. of Salt Lake City have taken ingenious steps to meet the requirements for water on their \$744,000 desert grading and paving job near Glendale, Nevada. The grading specifications call for at least 90% compaction of fills, and in that section, 50 miles north of Las Vegas, it takes a lot of water to keep the material anywhere near optimum. Job conditions in this desert country, even in February, when these notes were taken, are very similar to those found elsewhere in midsummer.

Thin Lifts Prove Best

Optimum moisture for the prevailing material runs around 10 to 11%,



★ Trucks run forward then backward, to save turning time

but by the use of thin lifts (about 3 in.), satisfactory results are being obtained with 8%. The contractor is using 4 to 6 tank trucks all the time to keep the fills wetted down. Ordinary flat-bed trucks fitted with tanks holding up to 2400 gal. are doing the job. The water is sprayed on the fill by use of a standard circular sprayer fitting. The trucks run forward and in reverse, over the fill area, to save the time turning around would require. Sheepsfoot rollers follow closely behind the water trucks to prevent excessive evaporation losses.

The Muddy River which runs along the Glendale end of the project provides the principal source of water. The contractor has drilled a deep well on the other end as a supplementary source.

Gravity Flow

Fast loading is considered essential to keeping all of the trucks operating efficiently. Gibbons & Reed have installed a system something like that used for filling railway locomotive water tenders, to solve this problem.

A high bank, near the Muddy River and just off the main highway, was chosen as the location for setting up a steel water-storage tank having about a 10,000 gal. capacity. The tank was installed 25 ft. back from the edge of the bank. A depressed ramp in the form of a roadway was then excavated in a horseshoe shape around the tank with the lowest point, at the middle of the ramp, next to the river. The elevation of the low point of the ramp was figured so as to allow the top of the water tank on the truck to be about 3 ft. lower than the bottom of the storage tank. An 8-in. steel pipe was connected into the side of



★ Storage tank as seen from main highway with 2400-gal. tank loading on excavated ramp. Note water being pumped into top of tank from Muddy River at right of picture

the storage tank near the bottom and extended far enough out over the ramp so that the end of the pipe would be directly over the tank truck's loading manhole. The 8-in. pipe was fitted with a gate valve which the truck driver can operate by means of a rope attached to a lever. While the pipe has an elbow at the end, it is necessary for the truck driver to attach a short section of either rigid or flexible pipe to the elbow as a connection into the truck's tank to avoid waste. With this arrangement, the truck driver runs his truck under the loading spout, gets out and performs all loading operations from the top of the truck. No

tank attendant is required. Trucks are loaded in approximately one minute.

Float Control

Water is pumped from the river into the storage tank by means of an electrically operated centrifugal pump which is set about 15 ft. above the level of the river. The water level in the storage tank is maintained by a float control which turns the pump on and off as required.

The Nevada State highway department maintains a small laboratory on the job to run continuous checks on the degree of compaction attained.



★ Sheepsfoot rolling followed the water trucks closely to minimize evaporation. Wetted portion of fill is shown by dark areas

Mexico's Highways



. . . being extended and improved in 200 million pesos program. How modern machinery is working alongside hand labor on the Inter-American Highway, and other observations from the Editor's 3,000-mile tour over the nation's highway

By Harold J. McKeever
Editor, ROADS AND STREETS

THE Mexican government is engaged in a national and Federal-aid highway program of record proportions. What of their design and construction practices? How do their problems and methods compare with ours? How are they organized? And equipped?

What progress is being made on the Mexican section of the Inter-American Highway, which some day will link the continents?

Here are a few answers, gained largely by the writer during a colorful tour of Mexican highways. This trip, taken last autumn soon after V-J day, would have been almost im-

possible without the cooperation of Mexican highway officials, and a word of thanks is hereby expressed for the friendly help of Gilberto del Arenal, Director General of Highways, to Francisco Rodriguez Cabo, Chief of Maintenance, Department of Communications, who arranged for my transportation, and to the engineers who accompanied me on the various automobile trips.

203 Million Pesos in 1946 Program

There are about 3,000 miles of roads under maintenance by the Federal Government (2,870 miles are

asphalt treated or paved). 2,800 miles are under different stages of construction under contract (1,000 miles with asphalt treatments). Besides that, the Federal Aid System covers 4,700 miles (1,600 miles asphalt treated).

The Federal Government of Mexico is conscious of the vital importance of extending arterial highways until all important regions and communities are interconnected and to prosecute the construction now under way.

According to General Director's recent information, for 1946 the budget provides the record sum of 203 million pesos Mex. cu., equivalent to 42 million dollars, to be spent as follows: Arterial construction, 28.5 million dollars. Federal-aid to States, 7.7 million dollars, maintenance 5.3 millions, and general expenditures 500,000 dollars.

Bridge construction has been an important part of the program and more than 100 major structures are planned for 1946 completion.

★ (Above): Two-yr. shovel on the Inter-American highway. Nearest parts depot 500 miles away in Mexico City. Photos by Harold J. McKeever

★ Spreading emulsion during 1945 treatment of the 40-mile Mexico-Toluca road, which carries 2,000 vehicles or more daily. Chip cover is being thrown on by hand.



★ Over 150,000 cu. yd. of rock was shot down in a distance of 1,000 ft. to build this canyon-side section of the Inter-American. Vertical blast holes were drilled from the top and horizontal holes at the side to bring this cliff down.

The sum of 28.5 million dollars which has been allotted to arterial construction, giving preference to the Inter-American Highway, to the Mexico-Ciudad Juarez and to the Guadalajara-Nogales highways. Many other important roads, that would be tedious to enumerate, will also be attacked.

The Mexico-Ciudad Juarez route will be open to through traffic all the way, by late 1946, with gravel roads in some sections and the use of a state road between Chihuahua and Jimenez.

The construction on the Mexico-Nogales highway will be prosecuted between Tepic and Mazatlan. South from Nogales the work to be done during the present year consists of paving a section of 32 miles to Santa Ana and the grading and drainage from Santa Ana to Hermosillo.

Progress on the Inter-American Highway

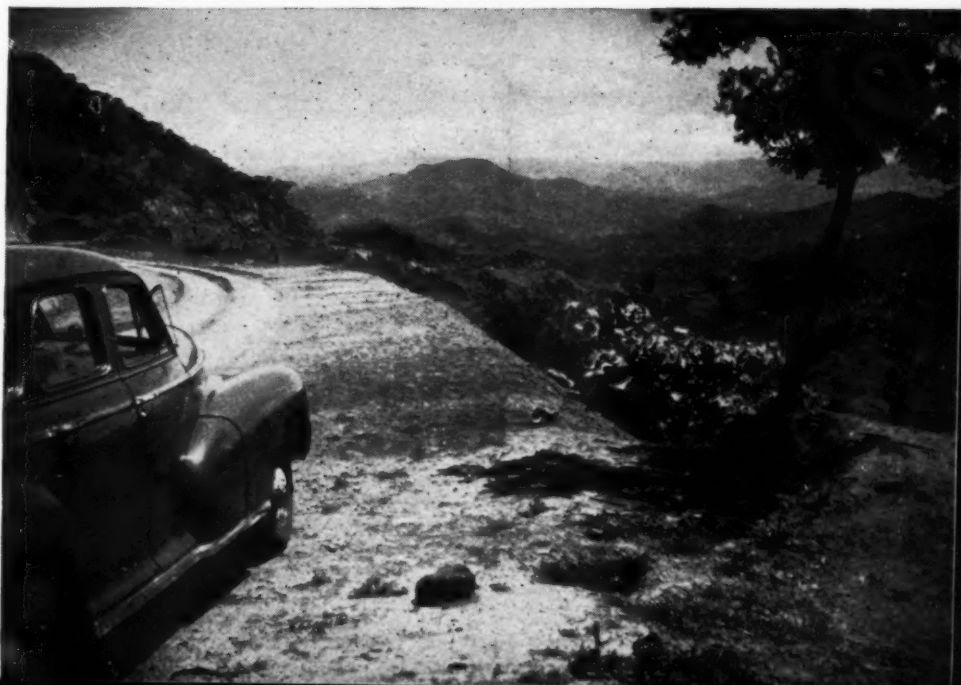
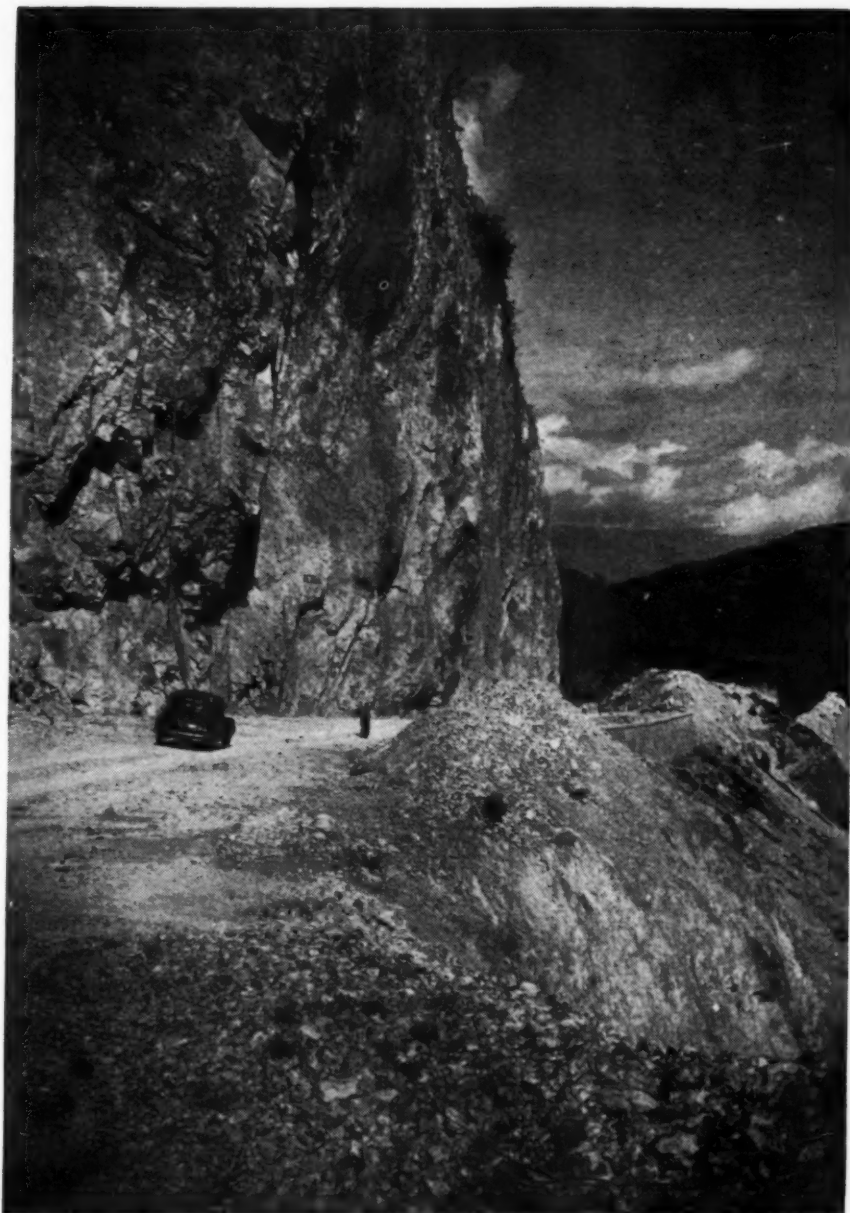
Using many detours and some temporary roads, actually it is now possible, at the dry season to drive as far southeast as San Cristobal las Casas. The 1946 program consists of the completion of the earth work between Oaxaca and Las Casas (395 miles), which will have a first class section, with a gravel cover and permanent bridges.

Gradient, Width, Curvature Standards

The following standards are employed for mountain sectors: Maximum grade 6%. Horizontal curves minimum radius 134 ft.; width of paved surface 18 ft., with widenings according to the curvature. Minimum width of shoulders 2 ft. For plain and for rolling country, higher standards are followed.

Grading: Hand Labor vs. Modern Machines

Passing as it does through a rugged mountainous region of scenic grandeur, the Inter-American Highway southeast of Oaxaca involves extremely heavy construction. During



★ New scenic grandeur awaits the tourist along the Inter-American Highway as he drives southeast from Oaxaca

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★ This shelf road section, through extremely hard granite on the Inter-American Highway, was being drilled for clean-up shots, using eight air drills powered by two 365 cu. ft. compressors via a 2½-in. line.



the three years that the grade has been pushed some 200 miles southward the design standards have been progressively improved (easier curves and grades wider sections, etc.) until excavation is running as high as 150,000 cubic meters per kilometer (31,400 cu. yd. per mile). The average on one contract visited was 80,000 cu. mters. (167,000 cu. yd. per mile). No wonder the 281 mile Oaxaca-Las Cruces link alone will cost 20,000,000 dollars equivalent.

Even is this land of cheap labor, considerable heavy equipment has been necessary for speed and economy. Modern compressors and hand-held drills predominate for blast hole preparation, although plenty of holes are still made with long steel bit shanks and hand sledges. Dynamite or black powder is used, or a mixture sometimes is deemed best for good shattering of the varied igneous rock formation. The practice was observed of blowing a pocket in a partially drilled hole with a small charge of dynamite, using no covering, after which the hole is reclaimed and hand drilling proceeds.

Power shovels of 1½ and 2 yd. are of course indispensable. The Inter-American contractors, however, have held shovel production down, to go easy on their old machines. Considerable side casting has been done on hillside locations. Good trucks have been scarce, especially in large heavy-duty types needed. Yet one contractor, Construcciones, S. A., has moved as high as 180,000 cu. yd. of 100% rock monthly along its 45-mile section, using three shovels.

A major item is the dressing of rock cuts. Along steep cut faces in the wake of the shovel, scores of laborers climb about from rock to rock with iron pries, loosening stones which might later roll down on passing vehicles. Construcciones, S. A., plans to step up this work with a small portable compressor and use of shallow clean-up shots drilled with jackhammers.

It has required several years for cuts on earlier sections to shake down, and dangerous slides and rock falls still occur frequently after rains.

Typical Contract Details

One grading contract section visited was the 45 miles of mountain location between Mitla and Nejapa, by Compañía de Construcciones, S. A., a

★ Grading for a tidewater bridge approach, in heavy-rainfall coastal area near Tuxpan.

large, well-organized Mexican organization. The company has been working for several years at this highway with contracts of some million dollars' value.

It is interesting to note that the contractors on the Inter-American are paid for materials and hauling by the cubic meter, but compaction and other processing are paid by machine-hours.

The 281 mile Oaxaca-Las Cruces section is being built by five Mexican contractors who have brought in all available equipment from other projects. Typical of the rather inadequately equipped outfits is that mustered in 1945 for the 66-mile Mitla-Nejapa section, under Compañía de Construcciones. The 100-man crew was served by 3 shovels, one dozer, one motor grader, one concrete mixer and 17 trucks. On other 22-mile contract, Portillo-Nejapa, there were only 2 shovels, one scraper and 6 trucks. Heavy rock trucks were first on this company's purchase list. Only about 100 pieces of power equipment were in use on five contract sections combined. However, much heavier outfits were at work farther to the south, and additional equipment has come in steadily to speed up this road.

Penetration Macadam Chief Pavement Type

Because of the availability of excellent road asphalts manufactured from Mexican petroleum, it is not surprising that asphalt is the chief paving material for arterials. Penetration type construction prevails in connection with a wide range of local materials. Emulsions have been popular due to the damp climate and frequency of rains in many areas. A large gallonage of cut-back asphalts have also been used, the main obstacle to their even greater use being the lack of heating and transportation equipment.

Typical of latest construction practice is the following procedure noted on the Inter-American Highway.

1. Graded sections are given a temporary gravel surface, awaiting fill settlement.

2. A base course is placed, employing crushed stone, gravel, hardpan or other selected material found within economical haul. (High percentage of rock on the Inter-American; little difficulty with soil or materials.) Motor graders are commonly used to spread stone. Compaction at or near optimum is being secured with heavy smooth rollers.

★ A 200-ton modern crushing plant; on the Mexico-Tuxpan highway.



★ Blading uncrushed gravel, later to be given a penetration treatment. Oversize pebbles a problem here.



★ Rubble masonry ditch linings, made with hand-mixed portland cement mortar, is "standard equipment" along eroding cuts.





★ Seen in the field shop of Construcciones, S.A., which has two large contracts on the Inter-American Highway. This company ships motors to Mexico City for overhauling, but makes many scarce parts here.



★ Widening shoulders by bulldozing backslope material toward the road

3. A slow-curing penetration oil (SC-1 or SC-2) is applied after dragging, at rate varying from $2\frac{1}{2}$ to 5 liters per sq. meter (0.8 to 1.6 gal. per sq. yd.), and allowed to penetrate for several days, depending on the weather.

4. A coat of RC-3 asphalt or emulsified asphalt (usually the latter) is then applied, and covered with sand graded between $\frac{1}{4}$ and $\frac{1}{2}$ in. Chip spreaders are supplementing hand work here. Modern distributors are used when available.

★ Culverts are still built largely of rubble masonry. Note also the rubble masonry rundown, served by shallow, stone-lined ditches along shoulder edge.



Maintenance Practices

Maintenance and repair work has included a wide variety of methods in Mexico, dependent on the climate, terrain, local material and available funds. Main roads have been kept in fair to excellent repair, and at the same time a great deal of progressive betterment has been accomplished by government maintenance, combining hand methods with latest mechanical equipment, when available.

Widening and relocation of more heavily traveled roads near Mexico City has been a major task, piecemeal by maintenance forces.

Perhaps the most unusual and spectacular work is the easing of sharp curves and progressive straightening and relocation of winding mountain roads. The nation's busiest inter-city road, the 40-mile section from Mexico City to Toluca, averaging over 2,000 vehicles daily, has been given such treatment in scores of once-dangerous spots, until the result is a virtual reconstruction of 50% of the distance to relatively high standards. The 45-mile road from the Capital to Cuernavaca has to be similarly improved.

A typical example of repair methods was seen on the high-elevation road between Mexico and Puebla. Curves have been widened and super-elevation increased by repair crews using hand-screened gravel to build up the high sides. Curves and failed areas were given a triple, open-type surface treatment. Stone in the successive layers was of 2-in., 1-in. and $\frac{1}{2}$ -in. maximum size, each layer being spread and raked by hand, rolled with a heavy smooth roller, and given an emulsion shot from a modern distributor. Then followed a final seal and stone cover.

More extensive repair or resurfacing projects have utilized crushing

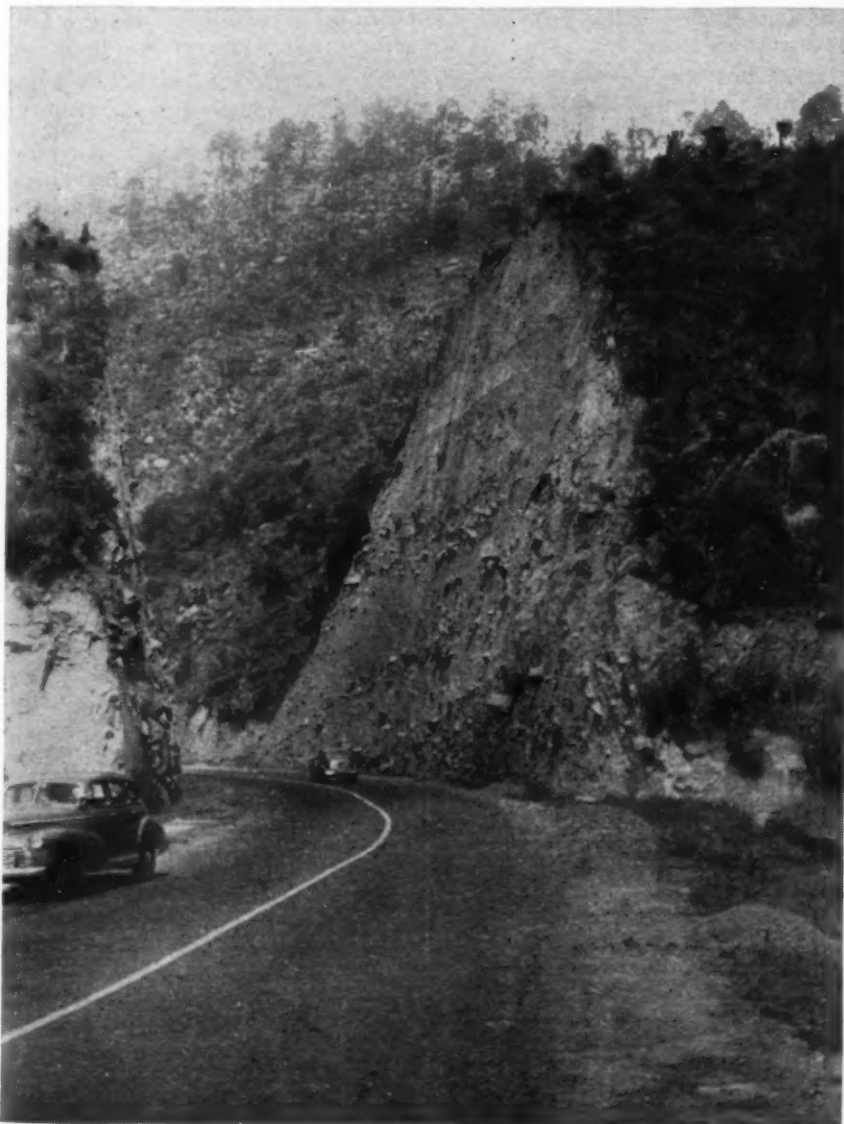
and screening plants, of which there has been a wartime scarcity. Considerable uncrushed gravel has been used specially in base construction. Oversize stones are picked out by hand or skimmed out by skillful manipulation of a grader.

Shoulder and ditch maintenance and betterment were everywhere in progress. Hand-methods still prevail, though use of power graders, small bulldozers and other equipment is increasing.

Erosion control is a serious problem, and varying preventive measures are commonly employed. Hundreds of miles of stone rubble ditch pavement have been completed, through cuts chiefly, but also along the shoulder edge on the low sides of curved embankments. Rundowns are of stone and mortar, concrete or sodded construction and even in urgent cases, corrugated iron, and wood are used.



★ A modern government-owned crushing and screening plant, set up to serve graveling operations. More such plants are badly needed.



★ How would you go about slicing a slope like this? Seen on the busy Mexico City-Puebla route

Slope protection likewise reflects an attitude of resourceful experimentation. Rows of small poles with brush lines; systematic plantings, seeding, and furrowing or benching, are among the methods observed.

Center striping is kept up on the busiest sections. Glass beads and white marble chips have been tried out, the former giving excellent results.

Signing and marking are being constantly improved, and here, too, reflectorizing materials have come into increasing use, on posts as well as on signs on main roads. Each district highway shop has a sign shop.

Organization

The "Dirección Nacional de Caminos" under the "Secretaría de Comunicaciones" has an organization not unlike one of the State highway departments in the U. S. The headquarters staff includes five technical offices in charge of Construction, Maintenance, Federal-aid to States, Bridges and Equipment. There are also some other auxiliary offices. 18 Divisions are under the Construction Department, from the Maintenance Bureau and Federal-aid to States has 30 technical representatives and 4 Zone Inspectors.

Two-way radio keeps headquarters in close touch with the branch offices and each one with the others.

An increasing amount of contract construction is being performed entirely by Mexican contractors. At least one of them is said to have more machinery than the National Department itself, a fact perhaps explained by the Department's restriction of its work to maintenance and repairs only.

The Necessity of Prompt and Continuous Maintenance

This practical observer dwells on such topics as economy of catching small breaks, correction of chronic slippery conditions, proper timing as to weather, better control of bitumen content. From a paper at the recent ARBA meeting in Chicago

By Ben H. Petty

Professor of Highway Engineering
Purdue University, Lafayette, Ind.

IN THE highway field, the acceptance of the meaning of the word "maintenance" is quite varied. Apparently it ranges all the way from a "do nothing" policy to major construction operations. At any rate, the reaction of such varied groups as township, county, city and state highway officials to the maintenance of roads and streets is far from uniform.

To me, maintenance of roads and streets means prompt and continuous (as needed) application of operations required to keep the road or street in a smooth, comfortable, safe and economical operating condition for its traffic.

What is it about a road that brings the greatest satisfaction to the average motorist? Isn't it a smooth road surface over which he can travel in comfort and safety at reasonable speed? The next time you catch yourself popping off to someone about the terrible road you have just driven over, stop and ask yourself, "Just what do I mean when I say that was a bad road?" Nine times out of ten you will probably admit that it was the rough, bumpy surface on which maintenance was sadly neglected that caused you to class it as a "bad road."

Should a series of questions be put to you about other features of that same road, the conversation probably would run something like this:

Question—"How about the road-sides, were the grass and weeds nicely mowed, trees and shrubs trimmed and in good condition, road signs ample, properly placed and in good and legible condition?"

Answer—"Oh, I really don't know. I didn't pay particular attention."

Question—"Were all the drainage facilities in good condition, surface ditches ample and well cleaned, culverts free of debris and mud, inlets and catch basins properly cared for?"

Answer—"Why, I never noticed those things."

Question—"How about the steel bridges, had they been thoroughly cleaned of rust and properly painted in the last twenty years, were the truss footings covered with dirt and weeds, were the abutments and piers in good condition and free from dangerous channel scour?"

Answer—"You got me there, I really don't know."

And we could go on with similar questions about additional road features, all of which are important from a road engineer's viewpoint. But all of them rate well below the condition of the road surface in selling the road to the average motorist.

Stitch in Time

And this brings us up to that old adage, "Put first things first." Get on to that road surface *now* and apply to each surface type the best known principles of repair and maintenance. The slogan of all maintenance men should be, "A stitch in time saves nine."

The prime objectives of maintenance are to protect the investment and satisfy the traveling motorists. The motorists provide the lion's share of road costs from their own pocketbooks. In Indiana, for instance, the motorists pay every penny of road construction and maintenance costs on both state and local roads, and (as of 1943) about 85% of street construction and maintenance costs in our cities and towns. It is true that we receive about 3½ million dollars a year in normal federal aid for highways but in turn Indiana motorists contribute about 5 million dollars a year in federal gasoline tax and close to 5 million dollars additional in purchase of the fed-

A small break in the surface of a bituminous pavement today may be smaller than my hand, but if neglected for days, weeks, or even a month, it will be widened and deepened by the continual pounding of traffic until you could bury a dog in it. In the meantime it may have blown out several tires, broken a few springs and will cost ten times as much to patch as it would have in the first place.

Now I don't mean to say that all maintenance should be limited to the road surface. But I do say that those things which contribute to a smooth, safe, comfortable riding surface should come first. On some types of subgrades, for instance, drainage may have a direct bearing on the condition of the road surface. Water is Public Enemy No. 1 to any road and the quicker we get rid of it, both above and below the road surface, the better the road will be.

Bridges are important, even though on a particular road they are few and far between. The painting of a steel bridge should not be neglected to the

eral windshield stamp for the privilege of using the highways. We should disabuse our minds of the idea that federal aid is a gift and that such funds do not come from the taxpayer, but are just picked off trees somehow, sometime, by somebody down in Washington, D. C.

What I am trying to put across is the fact that by and large we highway men are working for the motorists and not for any political party, chamber of commerce, farm bureau, real estate dealers' association, labor union, manufacturers' association or ladies' roadside development club. If we keep that in mind we are apt to do a better job.

point where it is so weakened by rust at critical points that it collapses under a heavy truck load. Or delay in repairing damaging scour under a pier or abutment may cause failure of the bridge.

Roadside development is desirable and contributes greatly to the enjoyment of travel over our highways. I am for it wherever men, materials, equipment and money are ample to provide it, *along with other highway needs*. But it should not curtail the adequate and proper maintenance of the road surface. A rough, bumpy, dangerous road surface may be paralleled by a beautiful roadside that would rival the finest golf course in this Chicago area, but it still would be classed as a bad road by 99 out of 100 passing motorists.

I was brought up under the old fashioned idea that roads are built to carry traffic and that traffic usually travels on the road surface and not on the roadside. Of course we want the cut and fill slopes sodded, or mulched and seeded, to prevent erosion and reduce maintenance costs. The "looking purty" part is desirable but incidental.

Permanent "Slippery" Signs?

And now we come to those nice white signs along certain stretches of our roads, on which is emblazoned in large black letters the doleful warning "Slippery When Wet." Some of them are so sturdily built and so substantially installed that they should last for years—and many of them do!

I wonder what the motorists think who travel such stretches of road year after year with that same old "Slippery When Wet" sign staring them in the face? That is a \$64 question, but I venture to guess the answer would be "Why in hell don't they fix it?"

It is an indictment of any maintenance organization to let such a condition exist beyond one full working season. A seal coat of heavy bituminous material covered with hard, durable, stone chips of about $\frac{1}{8}$ to $\frac{1}{4}$ in. size has done the trick too many times to question its validity. Or a covering of sandstone rock asphalt will stop the skidding pronto. The non-skid effect of the latter disproves the idea, prevalent in some quarters, that large sized stone chips are needed for such purposes.

Admittedly, in many of our states it is impossible to make proper repair of surface breaks during the winter season, but emergency repairs will usually suffice until warm weather ar-

rives. Actually, if proper and adequate patching, surface treating, joint and crack filling, etc., are done during the summer working season, there should be much less surface repair needed during the winter. In the northern states the maintenance men will have their hands full with snow and ice removal and control. It's tough, but necessary. When spring comes, you will have nothing to show for your expenditures of time, energy, equipment, materials, labor and aspirin tablets—except the satisfaction of having kept your roads open for the movement of necessary traffic, which after all is one of your prime objectives. And those who may be critical of the tremendous expenditures of road funds for snow and ice removal should be reminded of the fact that when traffic is blocked by snow and ice the road is earning no revenue. The gas tax earned during the winter by keeping roads open to free movement of traffic will pay a lot of bills for needed improvements next summer.

Right Time, Right Materials?

Timeliness and correctness of materials and methods are tremendously important in road maintenance. Take bituminous seal coating or surface treating, for instance. It is generally agreed that best results are obtained when bituminous work is done in hot weather. But how many times have we seen such treatments delayed until the cold, rainy fall season only to discover by the following spring that most of the surface treatment is out on the shoulders or in the side ditches. There is little excuse for such waste of road funds.

Bituminous surface treatments need a few weeks of hot weather after placing so they will properly cure, compact and seal under traffic. This goes for a lot of our plant mixes, too. If they bleed a little during those few weeks of hot weather curing, what of it? A prompt application of small-size, hard, angular chips will act as a blotter, add somewhat to the thickness, and probably increase the non-skid qualities of the surface. At any rate, a little bleeding from hot weather placement is preferable to a lot of ravelling from cold weather placement.

How can you tell when an intermediate or low-cost bituminous road needs a surface treatment? You can't determine it by riding over such roads and jotting down in your notebook such items as, "Road section A needs a surface treatment this year and road section B can go another year before treating."

To find the treatment answer, you will have to get out and dig into the road, here and there, to see if the bituminous material is still alive and securely binding the aggregate below the immediate surface. Many times you will find that instead of a surface treatment of $\frac{3}{4}$ to 1-in. all that is needed is a thin seal coat to renew the thin surface deterioration.

What % Bitumen?

About ten years ago I participated in a project to cut samples from road-mix bituminous surfaces in Indiana on which laboratory tests were run to determine gradation of aggregates and bitumen content. Scores of samples were obtained from various parts of the state. To our surprise, we found that the bitumen content, by weight, varied from 3 to 11%. Don't laugh, because you would probably find the same condition in your own states if you took the trouble to analyze your own road-mix jobs.

These variations sometimes occur in samples taken a few hundred feet apart on the same road. Variations in thickness of the mixture, in the gradation of the aggregate, application rate, etc., are no doubt responsible. This is an argument for plant-mix, the use of which seems to be increasing.

In some states, the maintenance men's biggest headache is that of pumping joints on concrete pavements. This problem has been with us for some time but has been intensified during the war by the patriotic acceptance of excessive truck loadings. Correctional procedures have involved mud jacking, or better yet, the practice of pumping a heavy asphalt cement under the sunken slab sections as developed by Ohio engineers. Actually lifting the settled slab-ends back into position by these methods has been handicapped by the faulted dowel bars at the joints. The Joint Highway Research Project at Purdue University has developed a rather simple method of jacking the settled slab-end back into position, then pumping a asphalt cement through drilled hole in the slab to fill the voids.

Suggests Joint Elimination

Such operations eat up a lot of maintenance money and methinks I can hear the maintenance men mumbling in their beards, "Why in hell don't the design boys do something about it?" That is more than a \$64 question. My suggestion would be that they discard expansion joints completely except at bridges, culverts,

railroad crossings, paved highway intersections, etc. Wherever you put an expansion joint in a concrete pavement you are inviting trouble for the maintenance men.

A rise of 1° F. above the temperature at which the concrete was placed sets up in each square inch of the slab cross-section (if restrained) from 15 to 20 lb. compression stress, depending on what value is given to the thermal coefficient of expansion and the modulus of elasticity. Most states forbid the laying of concrete at temperatures below 40° F. The maximum temperature ever to be expected on the slab surface should not exceed 140° F. This gives a maximum possible temperature increase of 100° F. which should build up a maximum compression stress of say 2,000 psi. Any acceptable concrete pavement should be good for much greater stress than that.

Of course, if we don't keep the contraction joints (if used) and contraction cracks sealed, they will accumulate dirt and sand when open in cold weather which will prevent complete closure in hot weather and thus build up the compression stress to possible failure. But occasional blow-ups can be repaired much more cheaply than expansion joints can be maintained. And blow-ups do occur on pavements with expansion joints!

Gravel Base to Prevent Pumping

Pumping can be prevented by placing and compacting an ample course of granular material on the subgrade prior to laying the slab. Preferably this layer of granular material should extend out to the side ditch to facilitate drainage.

New England states to the east and Oregon on the west coast have followed this practice for years to very great advantage. The results are there to see, the procedure has been written up in technical publications and broadcast from rostrums like this down through the years. But apparently many states never heard of it, or simply ignore the idea and continue to send good money after bad in building concrete pavements on pumpable, frost heaving subgrades and let the maintenance men take the heat for the unfavorable performance.

There must be many state and county maintenance men here whose particular maintainance districts have little or no mileage of brick, concrete or bituminous surfaces to maintain. Their headaches are generated by the maintenance requirements of traffic-bound stone and gravel roads and probably with an appreciable mileage of earth roads in addition. By far the greater share of our highway

mileage falls within this classification. The men who are charged with the responsibility of maintaining them are faced with about as many perplexing problems as are their brethren who maintain the higher type surfaces.

Usually there is little money available for the care of earth roads. Maintenance is limited to reshaping in the spring and an occasional blading or dragging after rains. If funds are available and their expenditure can be justified for such a purpose, dust may be controlled by the application of calcium chloride or road oil. The latter has the added advantage of water-proofing the surface and preventing mud in the wet seasons. Both may be "gone with the winter."

All aggregate used on the traffic-bound stone or gravel road should pass a ¾-in. sieve. You are inviting trouble, criticism and more costly maintenance if you use larger particles. Maintenance of gravel and stone roads requires patrol operations of blade or drag equipment to keep the surface smooth. Frequency of repetition of these operations varies with the type and volume of traffic carried. Blading or dragging must continue as needed through both wet and dry seasons.

The theory held in some quarters that drag-maintenance operations on such roads should be discontinued in dry weather is false. Granted that better results are obtained when a gravel surface contains considerable moisture, nevertheless traffic makes such roads rough, and since traffic continues in dry as well as wet weather, the blade or drag maintenance must continue also if we are to keep the road surface smooth and acceptable to motorists.

Stabilization—When?

When traffic becomes so heavy that such roads must be dragged every two or three days, then it is time to turn to some method of stabilization, thus eliminating the excessive dragging. If the road metal contains sufficient fines, calcium chloride will eliminate dust and provide a surprising degree of stabilization if properly handled. A bituminous surface treatment of about one inch, or, better yet, a bituminous road mix of two or three inches will give more lasting and better results throughout the year. But of course the bituminous treatment will cost more.

Which brings us to another unalterable fact which is frequently overlooked, namely, that in road work as
(Continued on page 130)

In Days of Old

Roads and Roadbuilding in Years Gone by



★ The first mile of concrete highway in the United States built on Woodward Avenue, Detroit, by the Wayne County Road Commission in the spring of 1909, between six mile and seven mile roads. It was laid as an experiment. Picture during construction shows, left to right: Roert D. Baker, contractor, and George A. Burley, engineer

Snow Traps

Cut Our Plowing Costs

... says this county road superintendent, who also has stopped the laborious business of raising snow fence.

By Harold R. Smith

County Road Superintendent,
Antrim County, Mancelona, Mich.

LAST winter if you had been up in Antrim County, Michigan, at the right time you'd have seen crawler tractors equipped with V-plows out working in the fields along the roads. No, they weren't digging up turnips or parsnips, but they were doing a trick that has saved a lot of snow plowing expense in this county. They were making snow traps.

A snow trap consists simply of a trench plowed parallel to the highway in locations where you would ordinarily think of putting up snow fence. The trench, combined with the flanking ridges of snow left by the V-plow, acts as a large-capacity snow stopper. The ridges are usually built up to a height of 5 or 6 ft. or more, in successive passes. The traps are begun early in the winter with a motor grader and kept open by repeated passages of a tractor plow. Two tractor-mounted V's are used principally for this purpose.

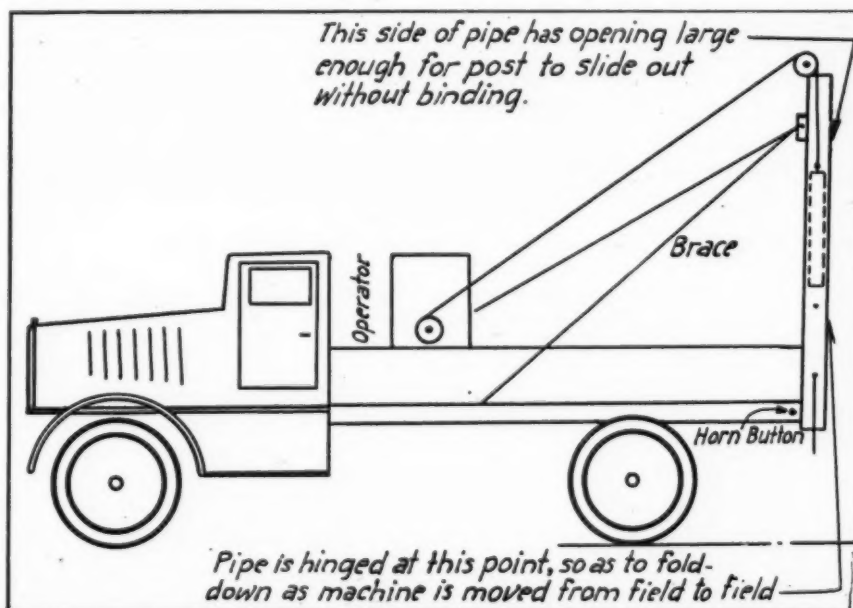
Pays Off in March

This is an expensive operation in immediate cost, as shown on the early-season cost records. But when late winter and spring roll around the operation really pays off. Highway

cuts or pockets that ordinarily would drift full and require repeated opening up with a blower or bucking through with heavy plows, can often be eliminated as winter trouble spots by the use of well placed traps.

During a bad blow this relief may make the difference between keeping a route open and having it get away from the plow crews.

Antrim County, with one of the heaviest snowfalls of any county in the United States (133-in. average, 190-in. maximum) puts up the usual 4-ft. snow fence. Its 410 miles of state and county plow routes have required about 60 miles of fence. Erecting the fence each autumn is enough of a chore, and raising later in the winter is slow going. With

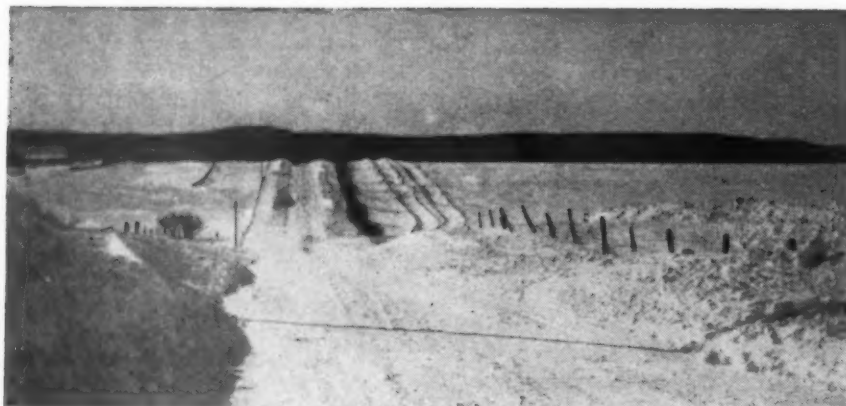


★ Details of winch-operated post driver which can set 800 posts a day



★ Tractor opening a trap the second time





★ Note snow traps (black strip) on right side of road



★ This view shows the amount of snow storage one trip thru a trap will give



★ The one rotary owned by Antrim County has its hands full every winter

labor so scarce little of it has been raised in the past few years. Instead has grown the practice of plowing traps, and many of these traps are plowed immediately in front of buried fence, in lieu of raising the fence. One ridge of the trap further buries the fence, but this is not objected to since the fence won't be touched until late spring.

Post Pounder

Fence erection has been speeded and labor saved in Antrim County by the use of a post driver. It consists of a vertical length of 4-in. steel pipe through which a 3-in.-diameter, winch-operated drop hammer falls. The outfit is supported by an upright mast mounted on the rear of a truck. The truck moves to the desired point and the post is usually driven with only seven hammer blows. Three men have been able to drive 800 posts a day with the outfit, as against 500 posts with 5 men using the most efficient hand tools.

See the drawing for details of this unit. In making this post pounder we used a piece of 4-in. pipe 13½ ft. long. A slot was made at one end 4½ ft. long and wide enough to allow a post to slide in and out without binding. The bracket that holds the pipe to the bottom of the dump box is made in such a manner as to allow the pipe to hinge on the top stud and fold down onto the truck, for passing under low wires and for going to and from the garage. The hammer is made out of a piece of 3½-in. shafting 4½ ft. long.

Posts are loaded into the truck dump box and moved into the fields. One man operates the winch, one man removes the posts from the dump box, holding each one separately under the hammer, until they are driven to the proper depth. We have a button on the rear of the truck that operates the truck horn. As soon as a post is in the ground the proper depth, the rear man signals the truck driver (by blowing horn) to move to the next post. A 10-foot stick is hooked to the rear of the truck and allowed to drag. As the end of the stick comes even with the last post, the rear man again signals the driver to stop to drive a post. This eliminates the necessity of measuring the distance between posts.

Tree Planting Obstacle

The county's use of traps has forcibly demonstrated the value of building up natural windbreaks. During 1945 a start was made on a long-range tree planting program, to be conducted cooperatively by the county road commission, county farm bureau



and state soil conservation commission. Nearly 40,000 evergreen seedlings were set out from a nursery established on land adjacent to one of the county garages.

An obstacle to tree planting is the lack of cooperation by farmers, who need to be sold on the benefit to them of giving a strip of ground to further this program which will result in lower winter road costs and better winter transportation for all.

The county's snow fighting outfit includes one rotary, 10 heavy trucks, 7 medium trucks, 2 motor graders, 2 track-type tractors, and (recently acquired) a heavy-duty V-plow outfit with a rotary-blade wing. While main dependence is on V-plows, one-way plows are used on some of the medium trucks, and under-body blades are mainly used during early winter. Until the snow accumulation reaches considerable depth, this equipment, working the trucks in pairs, can take 16 to 20 ft. of width and get over a large mileage. As the going gets hard, a one-way plow is teamed up with a following V-plow. Especially of late, when much of the equipment is old, the practice has been almost invari-

ably to send trucks out in pairs.

In contrast with more populous counties and with state-operated plows in other states, this county attempts virtually no night plowing after the first light snowfalls. Experience has shown that a few plows in the ditch can cause a great deal of equipment delay, since the ditched unit must be towed out, and often towed clear in to the garage for thawing out and starting. Motor graders equipped with snow wings also work all winter, and one heavy dozer is kept busy in tough spots. All county road equipment is selected for year around use wherever possible, the summer and winter use of under body blades being another example.

Snow plowing costs for recent periods are reported by Antrim County as follows: during the 1942-43 winter (192-in. snowfall), \$117.56 per mile average for 313 miles of county truck and county local roads; during the 1943-44 winter (98-in.), \$53.60 per mile, same mileage.

Removal costs on 104 miles of state trunk routes averaged \$103 per mile for the winter of 1942-3 and \$81 for 1943-4.

Clay Sewer Pipe Association Announces Expansion Program and New General Offices

General offices of the Clay Sewer Pipe Association, Inc., will be located in the Huntington Bank Building, 17 South High Street, Columbus, Ohio, after February 1, 1946.

Previous to this time the Clay Sewer Pipe Association, Inc., has maintained offices in the A.I.U. Building, Columbus, O., but a new expansion program being inaugurated by the Association has required enlargement of offices.

The new general offices of the Association in the Huntington Bank Building, Columbus, O., have floor space nearly three times as great as that previously maintained by the Association, and have been completely redesigned and decorated.

The Officers of the Clay Sewer Pipe Association have announced that an immediate expansion is being made in the Field Engineering Staff of the Association. The research and promotional work already carried on by the Association for the benefit of the engineering and architectural field, and the consumer market, as well as for the manufacturers of Clay Sewer Pipe and allied products, will be greatly intensified by the addition of new engineers. The additional field engineering personnel to be announced as soon as the current expansion program is completed, will be made up chiefly of World War II Veterans.

The mailing address of the Clay Sewer Pipe Association, Inc., after February 1, 1946, will be the Huntington Bank Building, Columbus 15, Ohio.

Pennsylvania Plans Huge Airport Expansion

Mayor Samuel of Philadelphia recently announced a \$20,000,000 program for the city's Southwest and Northeast airports. The former in particular is to be greatly enlarged to become an ultra-modern air terminal more than double present size, with spacious hangars and double runways able to handle 120 domestic and ocean-going flights an hour.

The Southwest Airport's present runways are to be widened, lengthened and strengthened to accommodate the largest planes now on the drafting board. The Northeast field, in commercial use this winter, is to have terminal buildings, hangars and expanded ramp areas.

Texas Bridge Footing Shafts

Drilled and Under-Reamed

Contractor cuts costs with unique auger and under-reamer, installed as special "front-end" equipment on crawler crane. Method limited to dry, non-caving underground material

By James P. Exum

Bridge Engineer,
Texas Highway Department, Austin

A DRILLED, concrete-filled shaft with a bell-shaped under-reamed footing, the first foundation of this type used by the Texas highway department, has proven successful and practical for the foundation of the South Concho River Bridge in San Angelo, Texas. On the basis of alternate bids a considerable saving resulted in use of this method over footings supported on precast and driven concrete piling. There was no difference in the design of the bent above the ground line. M. E. Worrell & Son, of Austin, Texas, is the Contractor.

The drilled shaft, two per bent, is 30 in. in diameter and the bell-shaped under-reamed footing has a 7-ft. base diameter. The sides of the bells make an angle of 30 degrees with the vertical. Column steel consists of vertical bars with spiral hooping and no footing steel is provided. A typical boring log was as follows:

0 to 22 ft. Loam and Gravel (Ground water at 16 ft.).
22 to 24.5 ft. Shale.
24.5 to 25.5 ft. Limestone.
25.5 to 26.5 ft. Soft Blue Shale.
26.5 to 33.5 Firm Shale (Bottom of bell at 30.5 ft.).

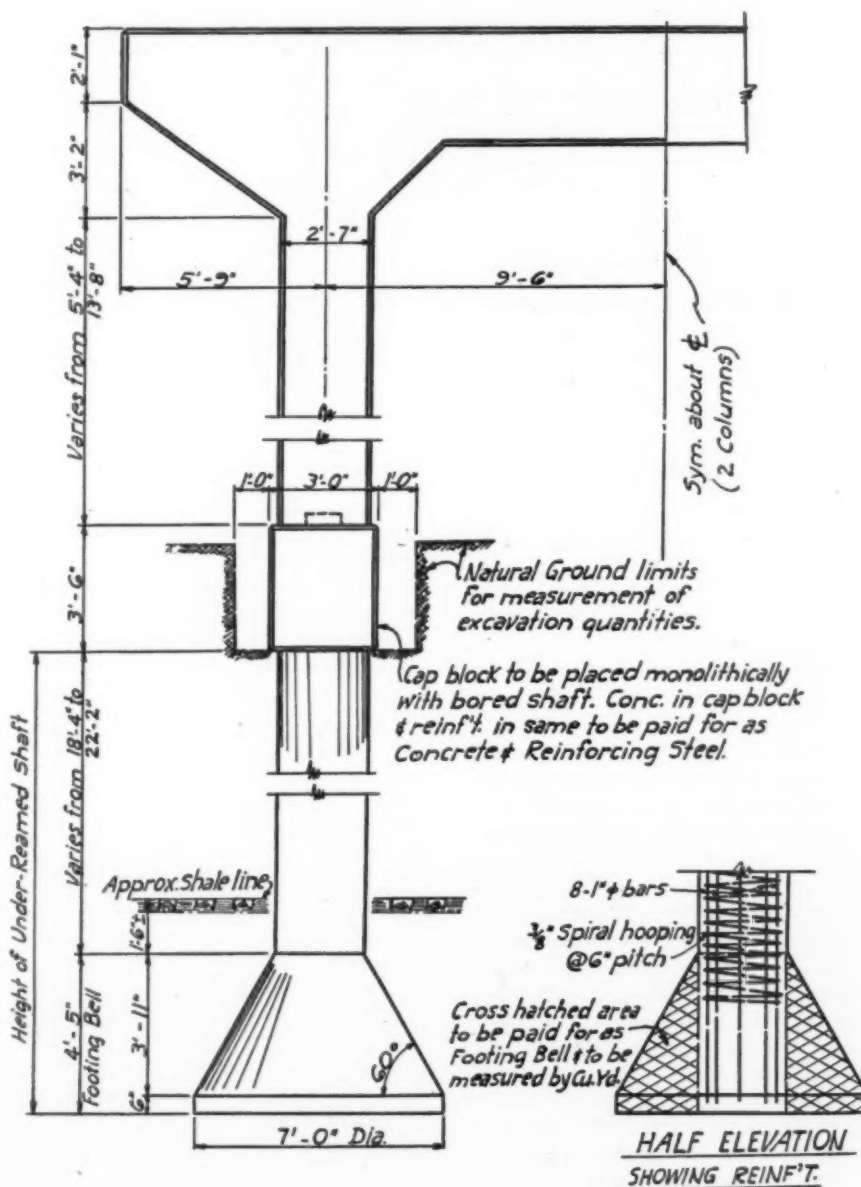
An altered one-yard shovel provided a power take-off on a horizontal table as pictured in the attached photograph. The unit had a 50-ft. boom suspending a square drill stem 50 ft. long which passed through the table. A 30-in. spiral auger was attached to the drill stem and rotated until filled. It was then withdrawn and emptied by short whirls and abrupt stops.

The hole was drilled in this manner until the limestone was reached. This was broken through by using the drill stem as a ram and the hole thus made was then reamed to proper size.

A 30-in. inside diameter steel casing was next placed in the hole and driven

into the underlying soft shale, sealing off the ground water. The casing was plumbed and pea gravel tamped around the outside to fill voids. Water

was bailed out and the auger again used to drill to the bottom of the proposed footing. An under-reamer replaced the auger and the shaft was

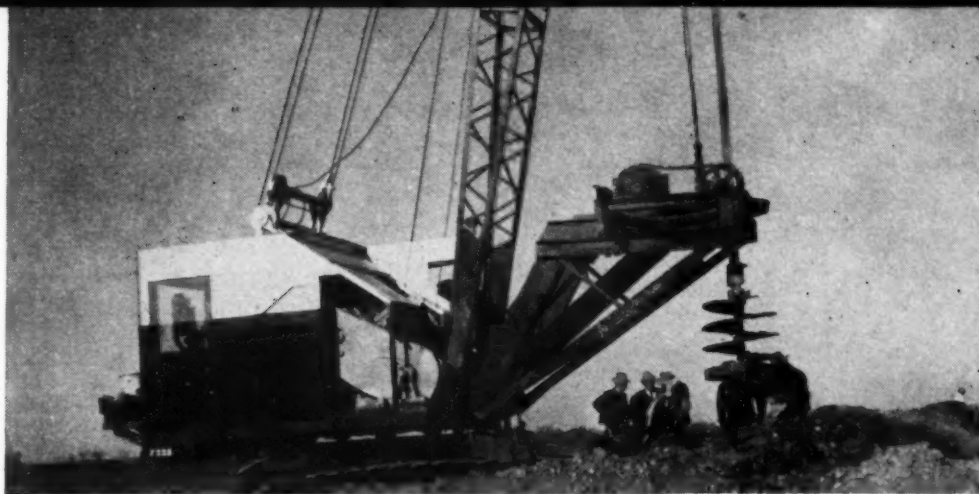


★ Details of footing of 2-column concrete bent excavated and placed by the method here described

belled out to the shape of a frustrum of a cone.

A man was next lowered in the hole and shaped the excavation to plan dimensions. The prefabricated column steel was set and concrete was placed through a tremie to a height of several feet above ground water elevation. The cylinder was then raised about one foot and the remainder of the concrete was placed, completely filling the casing which now extended approximately 18 in. above the proposed top of shaft. This extra concrete took care of the slump which occurred as the steel casing was removed. Construction above the ground line followed conventional methods.

The entire operation from the beginning of drilling to the pulling of the cylinder averaged about six hours



★ Drilling equipment and auger used by M. E. Worrell & Sons

per shaft or 12 hours for the completed bent at the ground line. This method of construction is limited to locations where the bell may be

formed in a material which is free of water and will not cave, and must be below a point at which all water from above can be sealed off.

Municipal Building in the Modern Manner

THE first postwar construction project for Royal Oak, Michigan, will be a new municipal building. Designed to house all activities of the public works department, it will combine utilitarian efficiency with a startlingly modern architectural treatment as pictured here. Clair W. Ditchy of Detroit, the architect, has completed plans and specifications.

The main section of the building will be a garage where all motorized equipment of the city may be stored, serviced, or repaired.

The building will also contain a sign shop, carpenter shop, dust-tight store room for voting machines, re-

pair shops for water meters, hydrants, and mains, traffic signal and radio patrol systems, sewers, and similar municipal services.

Closed shed storage for bulk materials such as calcium chloride and cement will be provided, as well as open shed storage for sewer and water pipe, and many other stocks which the department must carry.

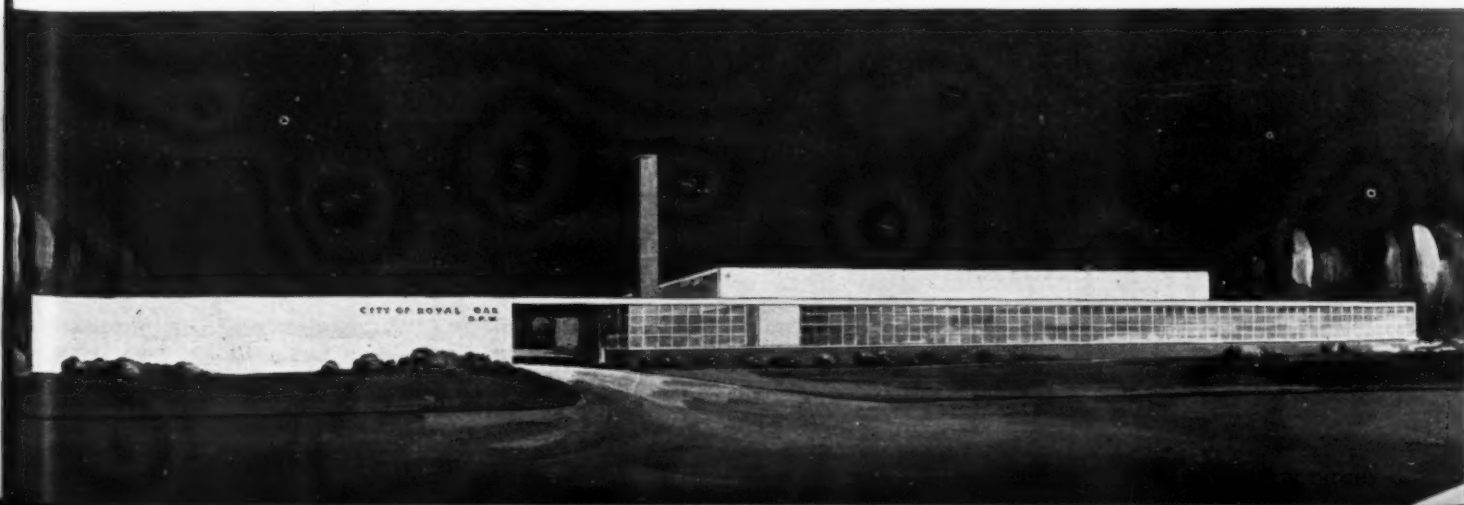
The building has been so designed and located on the site that any particular facility may be expanded independently, or added facilities may be accommodated.

An extremely important feature of the plan is the provision of a central tool crib, where all of the tools of

the department are readily available, for any of the various city services and where a proper record of them may be maintained. This in itself will effect a great saving in time and performance.

An assembly room which may also be used as a lunch room and a locker room and shower room have been provided for the convenience and comfort of the employees. The offices will be located near the main entrance.

The building will be built of modern fire resistant materials, with steel frame and windows, gypsum roof deck, concrete floors, brick and cinder block exterior walls.





★ Truck-mounted core drill bores Idlewild pavement

Test Coring

Concrete Pavement at Idlewild Airport

Actual strengths being compared with theoretical for 12-in. concrete slab at New York City's new municipal airport

DOWNER, Green and Carrillo, consulting engineers for Idlewild Airport, have employed The Haller Testing Laboratories of New York City to conduct strength and thickness tests of the three 12-in. reinforced concrete runways constructed last season. These tests, of course, involve cores taken from the finished pavement.

Test cylinders were taken during construction from each lane on about 2,000 ft. centers. Three cylinders were taken at each location. One of these cylinders was broken at 28 days, another at 90 days, and the third held for comparison with a core taken as nearly as possible from the same location. The care taken in making certain that the cylinders and the cores represented a sample of the same batch of concrete, allowed good correlation of the strength tests. While all tests have not been completed, the results so far indicate that the thickness is slightly in excess of the 12 in. specified and that all cores will show concrete strength in excess of 5,000 lb. The reinforcing mesh placed 4 in. below the top of the slab, apparently has made no difference in

the manner in which the cores break.

Special Truck Body for Test

The drill used in securing the cores is of standard design, powered with a 10 hp. motor equipped with a self starter. The pressure exerted for drilling is manually controlled to allow for various types of concrete and reinforcing steel to be drilled. A 50-gal. tank furnishes water for drilling.

A standard 1½-ton truck with a specially built body is used both to transport the equipment and to provide a mounting for its operation. Compartments built in the side of the body carry equipment such as extra shot and grit, plugs, barrels, tools, and other drilling equipment.

40 Minutes per Core

The drilling bit is manufactured of cold-rolled seamless tubing and has a spiral cut about 1 to 1½ in. in width. This cut facilitates drilling by allowing the shot or grit to be fed properly.

The abrasive material is either steel shot or grit, depending on the aggregates being cut. The Haller Co.

is equipped to do diamond drilling, but have found steel shot to be more satisfactory where reinforcing steel is encountered.

The amount of water used for drilling is dependent on the type of concrete being cut. Enough water should always be used to remove the sludge from the cut.

An average time of 40 min. is being required to drill through the 12-in. pavement.

Parking Surveys. In recent months the Public Roads Administration has helped to conduct parking surveys in Atlanta, Ga., Baltimore, Md., Providence, R. I. and Pawtucket, R. I. Similar surveys will be started in other cities during the spring and summer. The purpose of the surveys was to obtain a record of the number of vehicles that can be accommodated in existing facilities, including curbside parking space; to estimate the additional facilities required in downtown areas, and to determine the proper location and type of parking facilities that will be most advantageous to downtown parkers.

Future Construction Costs

By Halbert P. Gillette

ECONOMIC history repeats itself, and so do false prophecies as to prospective wage rates and prices. In 1919 average factory wages were double what they had been in 1914 prior to our entry into World War No. 1, and the same was true of construction wages. The "economic" prophets of 1919 confidently told us that such "abnormal wages" could not persist. The sky-rocket had ascended; the stick was bound to fall. Reject high construction bids, for lower "normal" bids would soon be had. Were they? They were not. Did wages recede? They did not, as is indicated in the table at the end of this article, which shows average factory wages at intervals.

In the second chapter of my Handbook of Construction Costs, a hundred pages are devoted to wage rates of many kinds and prices of construction materials in 1920 and for each of many preceding years. Perhaps the most important part of the chapter is an economic law (not previously published) to the effect that average wage rates tend to have the same trend as that of per capita money in circulation. At that time the Treasury defined per capita money as being all the money outside the Treasury divided by the total continental population. That definition has been changed, but in order to make comparisons with early years, I retain the old definition in the second column of this table.

The table shows that in 1919, average factory wages had become about 4.5 times what they were 70 years earlier; and that per capita money had increased almost exactly as much. It shows also that in the next 10 years wages rose 14%. When did the stick of the rocket come down? Not till the middle of the longest and worst economic depression in American history. Yet when that "stick" came down it was only 12% lower than the "rocket" had been in 1919. So much for the "prophets" of 1919.

The "prophets" of 1945 and 1946 are repeating the errors of their prototypes of 1919. They are doing so because they "reason" by "hunch" instead of really reasoning. Real reasoning on economic matters is based on statistics. The "hunchers" have been rejecting construction bids, and declare their intention of continuing

to do so. Some argue that to accept "abnormally high" bids would foster inflation. Others go farther and, like Dr. Neil R. Jacoby, Vice President of the University of Chicago, contend that it will be sound public policy to postpone public works, so as to give industrial construction priority of use of available manpower!

Between 1939 and March 1945, according to the Bureau of Labor, hourly wages in our factories increased 50%, and weekly wages 100%. The difference was due to overtime work at higher hourly wages. Factory strikers have aimed at securing a 30% increase in the hourly wages that existed just prior to the end of the war, and that would give them hourly wages nearly double those in 1939. They have been settling many strikes on a basis of 15 to 20% increase in hourly wages. Add 16% to 150% and you have about 175%, or an hourly wage 75% above that of 1939. That seems to be the "pattern" of factory wage increase to be expected for 1946. It is safe to say that construction wages will show at least as great an increase. Since there has been almost a "blackout" on construction, both public and private, for several years, it is probable that resumption of construction will be on a scale greater than before the war.

Since construction wage rates have risen in the same proportion as factory wages have risen, over long periods of years, there is high probability that in 1946 they will average not less than 75% above those of 1939. Construction material prices will probably show an equal rise, unless our government continues its pol-

icy of price control which will legally end next June 30. That policy is now under attack not only by nearly all business men and farmers, but by leaders of the American Federation of Labor. Leaders of the other great union will ultimately adopt the same policy when they realize that no extensive rise in wages can be maintained without a rise in the prices of commodities. While it is true that better machines and increased use of power will eventually cause commodity prices and construction costs to come down, such improvements are not effected over night, but over years. During the next five years average commodity prices might come down about 15%, were they now at a level determined by the law of supply and demand, operating freely; provided also that wage rates do not continue to rise. That wages will rise for several years is indicated by what happened between 1919 and 1929. That they will rise much more than in that decade is probable, for per capita money in 1945, as shown in the table, was four times what it was in 1935, and 2.8 times what it was in 1939. The big increase between 1935 and 1939 was mainly due to the effect of decreasing the weight of the gold dollar by 40%, by Presidential fiat. The shock to public confidence in our money caused by that fiat, explains why employment remained subnormal until the war began. And since nearly 20% of the working population was idle in 1939, wage rates remained relatively low, although they had risen to the level of 1919.

Political economists usually argue that since the number of dollars of money in circulation is vastly less than the number of dollars in checking deposits in banks, therefore increase in money circulation has a minor influence on wages and prices. But that argument overlooks the fact that American bank deposits have tended to bear about a constant ratio to money in circulation. At present such deposits are double what they were in 1939. Moreover there is an outstanding volume of war bonds convertible into money on demand that equals all the money in circulation.

Summing up the evidence, it seems to me probable that within the next five years average wages in America will be fully three-fold what they were in 1939, and that they will not recede from that level during the succeeding five years.

Factory Wages, Per Capita Money and Wholesale Prices

Year	Annual Wage	Per Capita Money	Wholesale Price Ratio
1849.....	\$ 247	12.02	83
1859.....	281	13.85	90
1869.....	378	17.63	122
1879.....	347	16.75	87
1889.....	445	22.52	89
1899.....	458	25.62	75
1909.....	516	35.41	94
1914.....	552	34.35	99
1919.....	1,141	53.71	198
1925.....	1,269	53.13	148
1929.....	1,300	54.33	136
1935.....	1,015	52.68	114
1939.....	1,152	79.97	110
1945.....	218.73	...

Footnote: Per capita money outside the Treasury as of June 30. Average wholesale prices of commodities in 1913 are taken as 100.

JOB and EQUIPMENT IDEAS

Send in your contributions to this idea exchange and help road building progress. **ROADS AND STREETS** will pay a minimum of \$10.00 each for any publishable field or office methods or shop kinks. Why not pass this along to your staff and encourage them to send in brief "how we did it" descriptions, rough sketches or snapshots.

Intermittent Stripe Marks Limit for Roller Operator

The surface course of a hot-mix resurface job on U. S. 30 N in Sandusky County, Ohio, was required to be placed and rolled to a limit line 9 in. inward from the edge of the old pavement. To help guide U. S. Construction Company's roller operator, an intermittent white stripe was painted on the rolled leveling course, as shown in one of the accompanying photos. Photo courtesy Ohio department of highways.



Keep the Ruts Ironed Out Between Rains

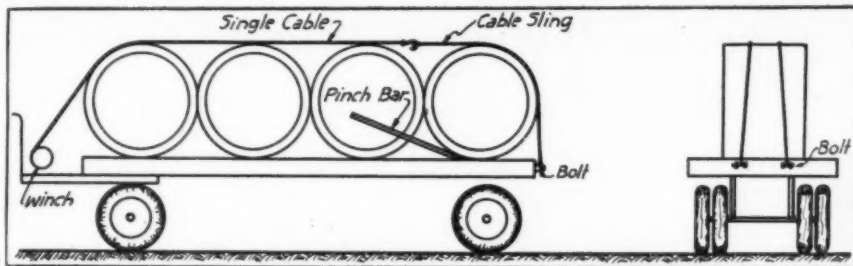
The photo of the rubber-tired tractor shows how Lombardo Construction Company of Cleveland scraped the surface of a large fill free from ruts and sheepfoot depressions on the Willow Freeway Project to facilitate surface drainage. A 20-ft. length of H-beam is being towed by cable fastened to either end. This was a tough pull for any rubber-tired rig in the wet, balled-up material encountered.

The contractor fought wet weather all season, having to disc and aerate much of his borrow material to keep going on doubtful days. He found

that it definitely paid to spend considerable effort to eliminate ruts that might hold rain water in event of rain.

Discing to reduce moisture to slightly below optimum was done with a disc outfit in which only every third of the discs remained, discs being spaced at 6 in.

Traffic Reaches New High on Bridge—It is estimated that on Jan. 20 approximately 100,000 vehicles crossed the San Francisco-Oakland Bay bridge between dawn and dusk, and thus far exceeded the maximum daily estimate of 80,000 made when span was constructed.



Abutment Forms Pre-Assembled in Contractor's Yard

Why not fabricate grade separation abutment forms in small, easily transported panels, in the yard where power saws and other equipment are handy? This method was used with success for a structure in connection with the current Hempstead Lake cut-off project on Southern States Parkway, Long Island, New York.

Andrew Weston, Inc., Woodmere, L. I., is the contractor. The grade separation involved is one of those attractive designs for which the Long Island Park Commission and New York State are noted, but which is strictly a headache to the contractor because of the fancy curved and warped wingwall surfaces.

The contractor apparently drew up detailed "shop plans" for wood form panels, as though the material was structural steel. Panels were built out in the yard in a flat position, hoisted in place with a crawler crane, and bolted together on a wooden platform for a "preview" in the contractor's yard. Then, having proved that "she'll fit," the men unbolted the panels and trucked them to the site nearby, where the crane paused from a clambshell chore to re-erect the panels quickly for the pour. One set of forms was re-used for both abutments.

58% of Livestock Moved by Truck.

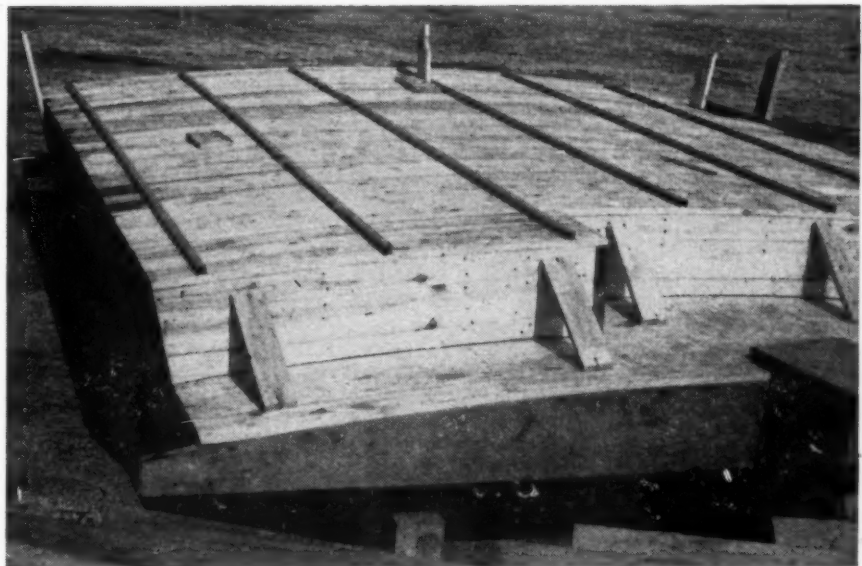
In a recent address Arthur C. Butler, Director National Highway Users Conference, stated that before the war 68% of cattle, 67% of calves, 70% of hogs, 34% of lambs, or approximately 58% of all livestock were moved to principal markets by motor vehicle.

Federal Funds for Airport Planning. As of Jan. 31, there had been advanced \$141,686 of Federal funds to help in the plan preparation of 17 airport projects estimated to cost \$5,188,164 when constructed, and in addition there were on hand on Jan. 31st, 27 applications for \$425,762 of Federal funds to help plan airport construction totaling \$31,282,000.

How to Roll Pipe Off Truck

Your editor has seen pipe rolled or dragged off of trucks by various schemes lately, some of which seemed

unnecessarily awkward. The accompanying sketch and reminder comes from Thomas N. Heron, engineer with the U. S. Waterways Experiment Station, Clinton, Miss., Mississippi River Commission. It is used to unload concrete pipe up to 72-in. in diameter. The method shown is considered by Mr. Heron to be the simplest and fastest under ordinary field conditions. You simply slack the cable shown, enough to roll the first pipe slightly off the end of the trailer with the help of the pinch bar, then lower the pipe to the ground with the winch.



"Give us road jobs so we can determine our costs," is plea of contractors at the

A. G. C. Convention

Over 800 contractors, chapter secretaries and other construction industry leaders attended 27th Annual Convention of Associated General Contractors of America, Inc.

HOW can highway bid prices come down if contractors aren't given initial jobs through which to settle their "contingency" fears, achieve "going concern" efficiency, and determine actual costs under postwar conditions?

How much can highway officials expect to save by postponing lettings, when substantially lower construction prices aren't in sight in the foreseeable future due to our huge national debt and other unprecedented inflationary factors at work?

Can the nation afford *not* to get going full swing on the highway program? Isn't the extra cost of letting a moderate volume of work now—in spite of relatively high bids—a small price to pay, considering the huge economic loss and growing accident toll penalty of delaying highway reconstruction?

These are among the challenging points brought out at the recent Chicago convention of the Associated General Contractors. This was their first full scale convention since the war. Our contractor friends have emerged in a strong position from a war period in which they completed over 50 billion dollars of construction in double-rush time. They also have emerged with a bewildering array of problems which make one wonder how a contractor can exist these days. Taxes, equipment shortage, legislative problems, accident prevention and other customary topics were covered, but prices and labor relations dominated the convention. How to reduce costs and do better work was restated as the goal of responsible contractors.

1946 President

Warren S. Bellows of Houston, Texas, was elected president of A.G.C. for 1946, succeeding Harry A. Dick, Portland, Oregon. Forrest W. Parrott, vice president, C. F. Lytle Co., Sioux

City, Iowa, was elected vice president to succeed Mr. Bellows.

Among the national leaders who addressed the general session were M. J. Hoffman, Minnesota highway commission and president elect of AASHO; Lt. General Raymond A. Wheeler, Chief of Engineers; John L. Haynes, chief, construction division, U. S. Dept. of Commerce; James R. Edmonds, Jr., pres., American Institute of Architects; G. K. Viall, vice pres. of the Chain Belt Company; Richard J. Gray, chairman, exec. council, Building and Construction Trades Department; and Rear Admiral H. G. Taylor, CEC (USN).

AGC's Growth

President Harry A. Dick in his opening talk traced the growth of AGC from 97 members in 1918 when Dan Garber called the first convention, to the present nearly 3500 members. He pointed out that the organization was founded out of a need to capitalize the experiences of World War I, a need which is paralleled today in many respects. Mr. Dick read a letter to President Truman offering the industry's cooperation on the 2,700,000 homes needed but pointing out the need for a balanced construction program.

A Public Roads spokesman foresaw that in the event a priority system is adopted to limit non-housing projects, urgent road projects would be approved as readily as perhaps any other type of work except veterans' hospitals. Possibly some large bridge projects may run into priority snags, however. But emphasis is on the fact that many road projects utilize only local aggregates.

Managing Director's Report

In his annual report the Association's managing director, Harold E. Foreman, reviewed the complexities facing contractors, but warned that

a deluge of construction is coming and that the industry must expand so that it can execute a possible annual volume of 20 billion dollars. It must welcome new contractors as well as train new personnel; must constantly improve its techniques. He foresaw a possible \$5,350,000,000 in privately financed and \$2,150,000,000 in new public works construction for 1946, despite the hesitant start.

Mr. Foreman predicted that shortages of materials will tend to limit construction volume in 1946. The wage-price muddle which has hit the nation is the most serious obstacle, however. The supply of new and used equipment, on the other hand, though not plentiful, will probably suffice.

As to contract conditions, he reviewed the difficulties contractors are faced with in doing business. These include inability to secure firm prices or delivery dates for materials, and uncertainty of labor supply and durability of wage rates, making it hazardous to guarantee completion dates. He said that many letting bodies or "owners" do not fully understand the necessity of increased costs.

The managing director reviewed at length AGC's labor relations service which since 1937 has grown into an elaborate and highly developed activity. Its prime function today is to help bring about a better stabilization of wage and working conditions, for longer periods, so that contractors can gauge their labor costs with more certainty.

Highway Contractors' Division Meeting

At the Highway Contractors' Division meeting outgoing chairman D. W. Winkelman, Syracuse, N. Y., handed the gavel to chairman-elect Morris DeWitt, Poplar Bluff, Mo. Jack W. Winneger, Portland, Ore., was elected vice-chairman.

The highway division's director,

H. J. Kirk, read a staff report; published elsewhere in this issue of "Roads & Streets."

The size of the overall 1946 highway program was estimated at 700 million dollars by A. G. Clark of PRA's construction division at Washington. Of this, 400 million is already definitely programmed by the states and plans preparation is accelerating. Mr. Clark gave four imperative reasons for speeding road lettings:

1. Safety. Over 23,000 miles of arterials are in bad shape; need immediate reconstruction.
2. Our commitments under the 1944 federal highway act will prove embarrassing if funds are not used.
3. A volume of road work now is necessary to hold road contractor organizations from entering other fields.
4. Unemployment relief, a consideration in setting up Federal-aid, is actually needed now in spot areas, including the west coast.

Mr. Clark said that contractors seeking to get high bids accepted on Federal-aid work must submit more definite proof of high material costs. Some contractors have claimed 300% increase in materials, but without offering proof. The average highway bid in 1945 was 22% higher than that of 1940, he observed. As to 1946 prices, Public Roads division chiefs, now vested with wide authority, are not concurring on awards in which the bids are more than 35% above 1940 but are referring such cases to Washington. This policy of setting an arbitrary percentage increase in a state, above which Washington referral is required, has the effect of setting a ceiling for that state.

Bids were rejected on 13% of \$100,000,000 worth of Federal-aid contracts between last September and mid-February.

Shorter Term Jobs?

The questions of highway contract size and time-limit were vigorously discussed. One point of view is that contractors today are hesitant to gamble on jobs that will last into 1947, but will bid readily on smaller jobs lasting a few months. Some projects would be bid more reasonably if broken up into functional contracts—clearing, drainage, grading, paving, etc.

As an instance—a 15-mile road job in Kansas, involving 190,000 sq. yd. of paving, was let in 10 phases. One AGC spokesman challenged the idea of reducing the size of projects, observing that a 20-40,000 sq. yd., short-term project is hazardous and undesirable to bid on because the contractor can't spread his job out long



★ Dwight W. Winkelman, retiring chairman, Highway Contractors Division, and Morris E. DeWitt, incoming chairman



★ Retiring president H. A. Dick (center), pres.-elect Warren S. Bellows (right), and vice pres. F. W. Parrott

enough to even up on weather breaks. He said that contractors can complete fairly large contracts in a single season today.

D. W. Winkelman endorsed this thought, saying that the answer lies in offering both large and small jobs. He observed that during the war, in spite of war conditions, surprisingly low costs were obtained on large airport and other projects where a large volume of work was performed on one site and in one continuing effort. You must get your outfit moved and organized—a large item regardless of the size of the job.

A PRA breakdown shows that 50% of Federal-aid road contracts (including possibly several functioned contracts on one project at a time) have been for less than \$50,000.

The spectre of force-account methods on secondary Federal-aid projects rose before this group, and was dispelled somewhat by reference to PRA's administrative memorandum on the subject [published elsewhere in this issue].

Mr. Newall, Texas AGC chapter

secretary, warned that some state highway departments are estimating too far ahead, with the result that their unit figures are obsolete. Texas jobs have had to be rejected for this reason, and the state highway department has acknowledged that the estimate was at fault in some such rejections.

Fewer Design Frills

One of the most important subjects covered was the possibility of redesigning road projects to eliminate certain design features, as a temporary policy, in order to permit a saving in hand labor or materials or both. Elimination of hand dressing of shoulders, ditches and backslopes is one of the chief economies possible. This specification change was okayed recently on New York state projects.

D. W. Winkelman suggested substitution of pipe culverts for box culvert designs for the time being, to save on-site labor.

But costs of highway construction per mile are irrevocably higher, on

the other hand, due to advances in standards of design. For example: 10 in. x 24 ft. concrete pavement with a 6-in. granular base is required today on Illinois arterials, as compared to a 9-6-9 slab 20 ft. wide on natural sub-grade in other years. New York grading work today costs 5 to 9 cents more per cubic yard, due to more stringent compaction specifications deemed necessary to secure a better roadbed.

Joint Meeting AASHO-AGC

Much praise was given to the work of the joint cooperative committee of AASHO and AGC, which has existed since 1937. This committee's Oklahoma City meeting during the highway officials' convention was reviewed [see H. J. Kirk's report, elsewhere in this issue].

Dick Hopkins, Albany, a committee member, emphasized a statement made by the founders of this committee, that both the highway departments and the contractors should be more interested in the wording of the general provisions of a contract plan than in the details of a specification. The former is ten times more important, according to one national highway engineering authority. General provisions need attention—they're the things which cost money and cause lawsuits. The public finally pays the bill for excessive highway costs created by burdensome, vague or tricky general contract provisions.

Morris DeWitt, further quoting from the joint meeting, challenged contractors to consider carefully whether their prices are out of line with other commodity prices, and if so why. Contractors like other business men must progress by offering as much for the money as possible and still make a fair profit.

Union Problems

J. D. Marshall, of the AGC staff, speaking on union agreements urged that contractor wage rates in each region be reduced to writing and be made to cover as long a period as possible. Uncertain rates and union demands are the biggest single bidding worry. AGC has pioneered in certain states through industry members on the Wage Adjustment Board. Zone wage rates have been legally established for all areas in Nebraska, Iowa, Kansas, and the Carolinas.

The old Board criterion of 15% increase over 1940 is not enough to attract workers to construction jobs. Non-union rates established in many areas are being exceeded by union demands, and the Wage Adjustment Board doesn't recognize two rates in an area. It was urged that in non-

AGC-AASHO Joint Co-op Committee

AASHO Members:

W. W. Mack, Chief Engineer, Delaware State Highway Department, Dover, Delaware (Joint Committee Co-Chairman).

C. M. Hathaway, Engineer of Construction, Illinois Div. of Highways, Springfield, Ill.

E. L. Roettiger, State Highway Engineer, Wisconsin State Highway Comm., Madison, Wis.

W. V. Baise, Chief Engineer, North Carolina State Highway and Public Works Commission, Raleigh, N. C.

A.G.C. Members:

Richard Hopkins, Albany, New York (Joint Committee Co-Chairman).

Morris E. DeWitt, Poplar Bluff, Missouri.

F. C. Nelch, Springfield, Ill.

D. W. Winkelman, Syracuse, New York.

Harry J. Kirk, Washington, D. C., and Hal H. Hale, Washington, D. C. (Joint Secretariat).

union areas, the AGC chapters go at once before the Board and get a stabilized rate adopted.

It was agreed that the development of legal wage rates in non-union areas is one of the industry's worst headaches.

Wage OK Problem

The WAB's regulations have been changed to where a contractor can apply for and receive permission to pay a given rate, but once set it can't be receded from. In reviewing the background for present wage policies, a spokesman recalled that during the war all employees had to receive approval for a wage increase. After V-J Day the national policy switched from wage control to price control. Under this new setup it was seen that the construction industry couldn't survive. So Washington was prevailed upon to continue the wartime regulations for this industry, including automatic regulation of adjusted price ceilings which allow for wage increases. The construction industry is the only industry having this provision.

Then, on Feb. 14, this setup was changed again. Now it is not illegal to grant a wage increase without a wage approval, but the employer is barred from raising his ceiling to compensate. On the other hand, OPA approval can be sought for adjusting

price ceilings to meet wage increases if this step is taken in advance of the wage raises.

Some highway contractors in New York state with a considerable volume of current work are stuck for 7½ to 15c wage increases under this rule.

On federal government contract work a contractor must go to the Wage Adjustment Board for approval to pay labor more. In a state contract the contractor must be sure he knows the legal labor rates for his state, which aren't necessarily those set forth in the contract proposal.

Every association chapter or local contractor group was urged to make a special agreement with the International rather than the local unions on highway work (laborers, operating engineers, carpenters, truck drivers); otherwise the Building Trades Council is sure to take over locally, as it has done in some areas, with its nineteen separate crafts and featherbedding rules and accompanying jurisdictional headaches. The council is geared to urban building construction and simply doesn't fit the needs of highway work; for example, its rigid hours of starting and stopping the day's work (8 a. m. to 4 p. m., etc.), after which overtime applies.

Airport Outlook

Association members were given a not too cheerful outlook for immediate airport construction. The big problem, whatever form the national legislation finally takes, will be local financing. The big, pending question in Congress: whether the states will control airfields, or the cities can deal direct with Washington. Only one state, California, has passed matching funds, having noted 90 million for "airports and other construction" from general funds.

C. M. Hathaway, construction engineer, Illinois division of highways, reminded AGC highway division delegates that it is the highway engineer's duty to reject excessive bids. He also said that we mustn't overlook one of the basic reasons why Congress passed the 3 billion dollar program: to give employment during the postwar conversion period.

Apprentice Training

W. J. Barney, of W. J. Barney Corp., New York, enumerated several points on apprentice training. Contractors need to do everything they can to establish a closer personal bond between apprentice and employer. He challenged a claim made by Richard J. Gray, a labor union official in a previous paper, that we

(Continued on page 101)

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(Continued from page 98)

have ample apprentices today. Barney observed that the union apprentice list is partly for mere replacement of union men, who average well up in years and are dropping out at the rate of 7% to 8% annually. He predicts a shortage of 300,000 skilled mechanics soon in the building and construction industry, which must be met by augmenting the usual 4-year apprenticeships with 8-month intensive training courses. He mentioned the successful Michigan program of sending apprentices to school 40 hours a week, alternating school periods with periods of work on an actual job, wages paid throughout from a trust fund established by parties involved.

Training must be jointly controlled by employer and union to insure a square deal all around, a setup which many local unions oppose. Contractors should be warned that modern apprentice training is costly, and

heavy obligations may be a burden in event of a sudden depression.

Airport Activities Increasing

T. P. Wright, Administrator of Civil Aeronautics, announced recently that airport planning in local communities has shown a sharp increase since the end of the war. Mr. Wright's statement is based on recent figures compiled by the Airport Planning Division of the Civil Aeronautics Administration.

Many hundreds of towns have requested information regarding airport development; a great number have asked for details concerning Federal aid. Construction is under way at other locations.

Road builders, equipment men and engineers will be interested in Mr. Wright's statement that U. S. cities have appropriated or have available a total of more than \$150,000,000 for airport development.

Excerpts, Staff Report of AGC's Highway Division

The complete report presented at the Association's recent convention covers numerous topics. Portions below discuss only contract aspects of recent federal highway legislation and regulations, the secondary road program, and reasons for current high costs

By Harry J. Kirk

Manager, Highway Division, Associated
 General Contractors of America, Inc.,
 Washington, D. C.

WE STAND today facing the inauguration of the greatest road and street improvement program in the history of our country. While highway building is beset with the same difficulties that plague all industry in the reconversion period, no other type of construction work is better prepared to go forward in such large volume in every state in the Union. Finances are available. Plans and specifications for an unprecedented number of projects are ready, and more are well on the way to completion. In spite of the problems involving manpower and materials, this is a time for optimism.

The regulations (of the Federal-aid Highway Act of 1944) provide that "actual construction work shall be performed by contract method unless

another method is recommended by the state highway department and approved by the Commissioner for the reason that under the circumstances, the interest of the public will be served, or that the proposed work is of a character not adapted to normal contract procedure."

In regard to projects in National Parks it is provided that "construction work shall be by contract, unless day labor work is specifically recommended by the Commissioner of Public Roads and approved by the Director of the National Park Service."

Other points of interest are:

1. No discrimination permitted against bidders not residents of the State in which the work is performed.
2. Contracts to be awarded to the lowest responsible bidder.
3. Contractor must perform 80% of the work on a project with his own forces.
4. No convict labor or convict-manufactured materials to be used.

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Fifth: First cost, operating and maintenance costs are less than for similar equipment.

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5. Minimum rates of wages shall be predetermined by State highway department and stated in specifications advertised.

Required Special Provisions

The P.R.A. has issued: A Required Special Provisions for Contracts involving Federal-aid, Grade Crossing, Secondary Highway funds and funds made available under the 1941 and 1944 federal highway acts. B. Optional Special Provisions.

Attention is directed to procedure in these provisions differing [in the first instance] from those issued in the prewar period as follows:

1. **Record of Materials, Supplies.** Under this provision as newly revised "the contractor shall maintain a record of the total cost of all materials other than equipment and supplies, purchased for and incorporated in the work and also the quantities and costs of the specific materials and supplies purchased for the project as listed below. Upon the completion of the contract this record shall be submitted to the resident engineer. The listed items shall be reported in the units shown and a separate report will be made of these materials and supplies used on structures over 20 feet long. The total cost of all materials and the total cost of each of the listed items of materials and supplies will be reported to the nearest dollar." The "listed" items are fifteen in number as follows: cement, aggregates (commercial), bituminous materials, lumber, timber, piling, metal culvert pipe, reinforcing steel, structural steel, petroleum products, explosives, ready-mixed concrete, premixed bituminous paving materials, concrete culvert and drain pipe clay, culvert pipe and drain tile, and aggregates (locally produced).

In answer to objections by contractors in regard to furnishing this additional information on quantities and costs, P.R.A. points out that "the Bureau of Labor Statistics, Department of Labor, is also concerned with estimates of the quantities and cost of materials used in highway and other construction work and is authorized by law to assemble such data by direct inquiry." In order to avoid direct inquiry by another Federal agency an agreement has been reached whereby P.R.A. gathers the data in the first instance and transmits it to the Department of Labor, Bureau of Labor Statistics.

2. **Sworn Affidavit on Wages.** In line with "the regulations of the Secretary of Labor promulgated pursuant to and by virtue of the authority conferred by section 2 of the Act of June 13, 1934, 48 Stat. 948, Title 40 U. S. Code 276c ('Kick-back' statute), as amended or revised," the contracts provide in part that "each contractor and subcontractor shall file with the resident engineer weekly, in duplicate if requested, a sworn affidavit with respect to the wages paid during the preceding weekly payroll period, as set forth in the payroll transcript submitted with the affidavit for work performed under this contract (whether done by the contractor or under a subcontract or otherwise). For each project an additional copy of each affidavit and accompanying payroll transcript shall be filed for the payroll periods nearest to January 15, April 15, July 15 and October 15."

3. **Selection of Labor.** "All qualified unskilled labor shall be employed insofar as possible from lists furnished the contractor by the employment agency designated in the contract. The contractor may avail himself of the services of the employment agency for obtaining labor for the intermediate and skilled grades."

Special Problems in Enlarged Secondary Program

Projects on the urban programs will run in many cases into large amounts of money. On the other hand, the work on the secondary road system will generally involve a large number of small projects built under simpli-

AGC Cooperation With Highway Research Board

The A.G.C. is to continue its close relationship with the Highway Research Board of the National Research Council. D. W. Winkelman is the A.G.C. representative on the Board. Recently the Highway Division manager has been appointed chairman of the Board's newly constituted Committee on "Economics of Highway Construction and Maintenance Methods." The co-operation of every member of this division is solicited in making a success of this new committee activity. It offers a great opportunity for the advancement of the industry.

fied plans and specifications. There is no precedent for the greatly enlarged program of low cost secondary road projects which may reach a possible annual total of \$300,000,000.

Engineers accustomed to designing high cost per mile projects are going to find it difficult to reorient their approach and modify the standards and specifications used so as to stretch the same funds over many more miles. County officials accustomed to proceeding with little or no preliminary plans and the use of the day labor method on their low cost road work, will be inclined in many instances to insist on continuing the use of this system endeavoring to get a concession under the P.R.A. regulations already promulgated and quoted above. (See A.G.C. Bulletin, May 14, 1945.) Some contractors, accustomed during the war to projects of large dollar volume, may refrain from bidding on these small jobs.

Cognizant of these special problems involved in the enlarged program on secondary roads the PRA announced the initial meeting of a "Board of Consultants for Federal-aid Secondary Highways." The following is quoted from news on this meeting:

"The Board of Consultants, before adjourning, adopted recommendations which subsequently were approved by the Commissioner of Public Roads as steps which should be taken to promote the development of an adequate system of secondary roads. These recommendations are:

1. It is unanimously agreed that the most important benefits to be realized from the Federal-aid secondary program are not only the limited mileage of improved secondary routes that will result from the expenditure of the Federal funds immediately available.

(Continued on page 106)



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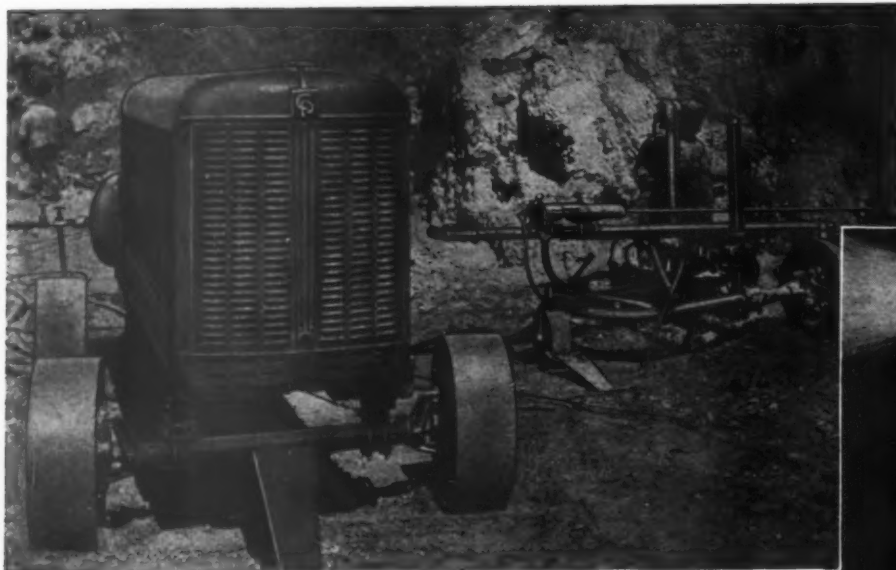
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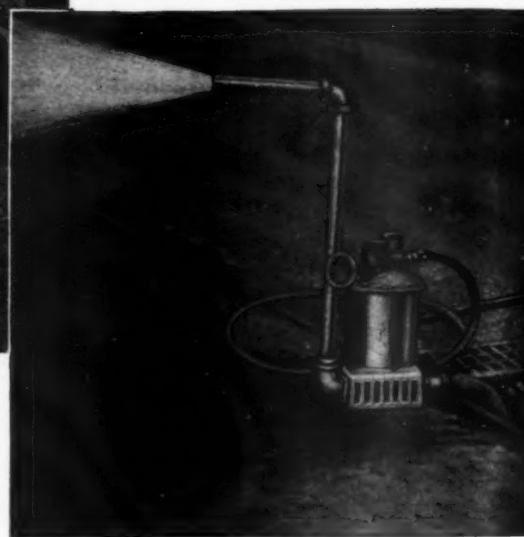
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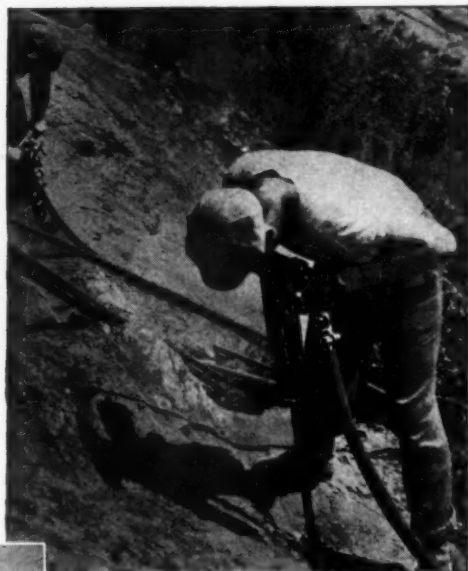
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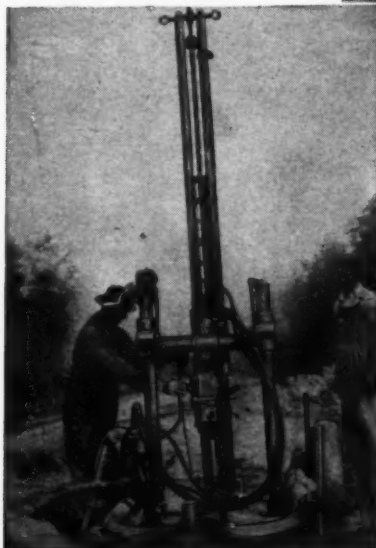
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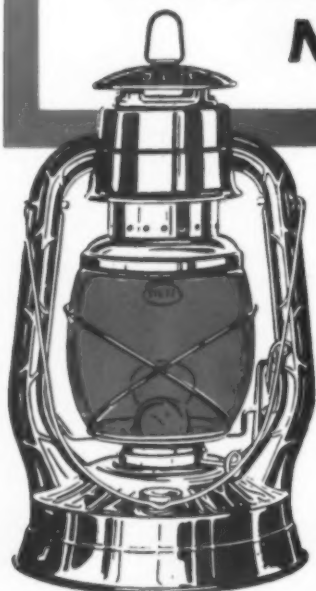
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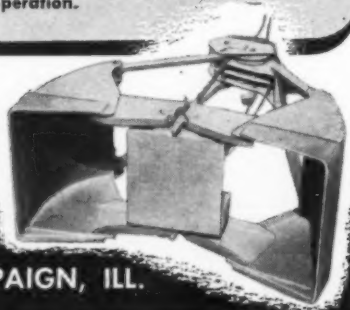
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(Continued from page 103)

able, but also the promotion of better planning, administration and engineering in all local road work which will result if close and continuing co-operation is achieved between the three agencies concerned—the Public Roads Administration, the State highway departments and the local authorities. Steps which will aid in achieving this co-operation are:

a. *The establishment in each State highway department of a Division of Secondary Highways.* The primary function of such a Division would be to co-operate with the local authorities in administration, planning, engineering, construction and maintenance.

b. *Encouraging development of competent local highway engineering.* An effective method recommended is the assignment by State highway departments of direct responsibility to counties or groups of counties for as much of the work as is feasible.

2. Counties should be encouraged to establish engineering organizations either individually or in combination of two or more counties.

3. The Consultants feel that the Federal legislation, rules and regulations and procedures are thorough and comprehensive and provide a framework within which the States and local authorities can operate effectively."

Special Action on Secondary Road Problems

Certain forward-looking A.G.C. Chapters have appointed Farm-to-Market Road Committees to make a special study of the new problems involved in securing low cost farm-to-market roads of the best possible quality with due consideration to low initial investment and a reasonably low future upkeep cost. It is reported that contractors have been able to make suggestions as to how slight changes in plans and specifications would save considerable money without in any way lowering the basic standard of roads. (This might apply to the higher cost types also.) Perhaps our contractors might be able to offer helpful advice to the Consultants.

Wage, Price Trends—What to Do About It?

On January 28, at Oklahoma City, there was a meeting of the Joint Co-operative Committee - AASHO - AGC. The question of present price problems was discussed. Among the factors mentioned as affecting current bid prices are the following:

(a) Increased wage rates.

(b) Lowered efficiency (labor and equipment).

(c) Uncertainty in material prices and delivery dates.

The greatest increase in bid prices is found on those job types that involve the greater proportion of hand labor, such as structures. Depending on the proportion of on-site labor, lowered efficiency is the biggest item. One element is the restrictions on the contractor's control of his organization, either under provisions in labor agreements or contract regulations affecting freedom of selection. It was stated that while wages as compared to prewar rates may be up only 30 or 40%, on-site labor costs may be up 100%. Higher productivity per man and hence lower prices, comes from technological advances and new equipment initiated, not by labor, but by the contractor spurred on by competition. Present wage trends and lowered efficiency will lead to further elimination of labor by machinery.

As to wages, the increases expected or granted in other lines—steel, motors, packing, etc.—will operate toward further increases in the highway field. The highway contractor, if he is to obtain labor, will have to pay higher hourly rates than is offered for inside employment. The influence of the Administration today is to increase wages. This was not the case after World War I.

With many uncertainties as to material prices, and probable further increases in hourly wage rates, it would appear that contractors must continue some further increase in bid prices, and that just as we face higher prices than prewar for food, clothing, etc., so we are going to have to pay on a higher level for highways.

Any sitdown strike now by awarding agencies will result in higher prices later than would otherwise be the case. The highway contractor today has a larger investment than ever on plant and equipment. The cost of idleness to him is, therefore, higher today than ever before. A vacation in road letting in the hope of lower prices will result in many highway contractors moving into other lines of endeavor with less competition and higher prices when the work is finally undertaken—and the longer the vacation the higher the prices.

It was the consensus of opinion that the highway program should be maintained at a moderate rate, that, if there is competition, the States should continue to award work.

The following resolution on this subject was approved by the Joint Committee:

"Resolved that the Committee recognizes that the prosecution of high-

A.G.C. Committee on Highway Specifications

This Committee was set up since the last A.G.C. Board Meeting to promote better specifications, contract provisions and construction practices. The Highway Section Chairman is Ralph Green, Des Moines, Iowa. He has already solicited the help of members. Any suggestions in regard to highways, airports, rural electrification projects and other work allied to the highway field will receive careful consideration.

way construction presents a problem common to all industry at this time. United effort must be made to promote a more stable condition so that much needed highway work can proceed. A moderate volume of work may accomplish the desired result better than a complete cessation of activity. The problem is one which can be solved best by a more thorough study of each other's approach to the subject, and it is recommended that serious efforts be made in that direction."

Cost-Boosting Frills

The contractor's chief function is to keep costs down. The competitive contract system is the best means to this end, and may be expected to restore a balance. However, the contractor needs the help of the engineer in curbing refinements of design and specifications that increase costs beyond value received. Costs may be reduced without undue sacrifice of high standards of utility and structural stability. While machines for finishing grading and pavement do give satisfactory results no machines have been developed to set concrete forms, or steel, or rub concrete, etc.

The following are some of the suggestions offered:

(a) Eliminate as far as possible hand finishing of structures.

(b) Grading specifications should keep hand labor to a minimum.

(c) Study design to permit use of standard forms for concrete structures.

(d) Curb the enthusiasm for refinements on the part of field engineers and inspectors that sometimes reach the point of supplementing actual requirements.

(e) As to compaction requirements, perhaps more tolerance from theoretical moisture content, and less refinement in material specifications, would help reduce costs.

AASHO Panel Discussion

The recent AASHO convention discussed the subject "Shall the Program Go Forward? What Are Excessive Prices?" Points brought out by the highway officials, confirming, in many respects, the findings of the Joint Co-operative Committee.

1. There is no foreseeable reduction in labor costs.

2. While bid prices in 1946 may be higher than in 1945, competition is keener, as evidenced by the greater number of bidders.

3. We can't put off the building of much-needed highways in the vain hope that prices will come down.

4. The greatest increase in unit prices occurs where there is the largest amount of hand labor. States are advised to go easy on structural items.

5. Average prices in 1945 were 50% above 1940 and 35% above 1941. The peak was reached in 1943. (P.R.A. data.)

6. After World War I, when unit prices on many items were actually higher than today, the States, nevertheless, went forward in awarding contracts on needed highways.

7. We should emphasize that highway projects are not competitive with other public work.

8. Above all the States are duty bound to go forward with the highway program.

Labor Relations on Road and Related Work

When it comes to labor relations on highway and related construction work the National A.G.C. is the only national organization equipped to look after the interests of the highway contractor. A.G.C. members and chapters are offered advice, and assistance in disputes, and information, advice and assistance in connection with government regulations covering overtime pay, legal wage rates, Wage Adjustment Board cases, etc.

The need for this type of service will, without doubt, increase as time goes on inasmuch as one of the problems of the industry at the moment is the difficulty of bidding a firm price without too much in the way of contingencies. It will be highly important to the highway contractor to make efforts to stabilize the wage and working conditions in highway construction to remove as far as possible the uncertainties which make bidding difficult.

Nearly one-third of the 14,000 miles of New York State highways are scheduled for reconstruction or replacement during the \$840,000,000 five-year public works program.

Back from Military Service

Joy L. Sherwood, Lt., C.E.C., U.S. N.R., served at Honolulu, Tinian and Okinawa in charge of Hdqs. Co. of the 27th Special Seabees. Mr. Sherwood has again assumed his duties as partner in the Sherwood Construction Co. of Wichita, Kans.

Glen W. Maxon Jr., who served with the 82nd Airborne Infantry Division and later with the 21st and 815th Engineer Aviation Regiments received a battle-field commission.



G. W. Maxon, Jr.

He is now a supervisory engineer and a member of the executive staff of the Maxon Construction Co., Dayton, Ohio.

Howard H. McClintic, Jr., has resumed his duties as president of Ferguson & Edmondson Co., Pittsburgh, Pa., after serving with the Navy as Commander.

Ed H. Honnen, recently a commander with the Seabees, has returned to his duties as president and general manager of the Ed H. Honnen Construction Co., of Colorado Springs. Enlisting in 1943, Mr. Honnen saw service in the ETO as well as in the southwest Pacific.



E. H. Honnen

Harold F. Gerold, decorated in two world wars, was named division engineer of Division III of the Ohio State Highway Dept., Jan. 12. Serving as a captain with the Seabees, he received the Bronze Star Medal "for meritorious service" in the Okinawa campaign.

Ralph A. Tudor, Col., district army engineer at Portland, Ore., will join Morrison-Knudson Co., Inc., Boise, Idaho, in an executive capacity on release from service.

R. B. Koss, Lt. U.S.N.R., has returned to his job as Vice President of the Koss Construction Co. Lt. Koss served with the Bureau of Ships in the Construction Div., Washington, D. C.

Melville E. Dark, inducted while in the employ of Porter-DeWitt Construction Co., rose to the rank of Major in the 825th Tank Destroyer Battalion. As Battalion Operations Officer he participated in the Northern France, Ardennes, Rhineland, and Central Germany campaigns. Mr. Dunlap has returned to Porter-DeWitt as Asst. Supt. and safety engineer.

Wesley C. Pietz is now back in his previous position as district manager, Pittsburgh area of the Raymond Concrete Pile Co. During 38 months with the Seabees, Mr. Pietz made the Normandy invasion and then turned up in Okinawa as Executive Officer of the 148th Battalion. Attaining the rank of Lt. Commander, he received the Bronze Star and the Croix de Guerre with the Silver Star for his work in Normandy.

R. B. Barkley, recently captain in the Corps of Engineers, has returned from the ETO to his old position of superintendent with the Bowers Const. Co. of Raleigh, N. C.

Thomas J. Scott, Jr., after participating in three major campaigns and five engagements in the southwest Pacific, where he earned the Bronze Star and Purple Heart, was separated from the 302nd Engineer Combat Battalion, 77th Infantry Division, Nov. 28, 1945. Mr. Scott held a reserve commission of Second Lt. in the Corps of Engrs. prior to the war and was promoted to the rank of Major while in service. He returned recently to his former employment with the Maxon Construction Company, Dayton Ohio, on the staff of designing engineers.



T. J. Scott, Jr.

Robert B. Dunlap, after spending 2½ years with the Seabees, as a Lt. Comdr., returned to inactive duty on Jan. 15th. Mr. Dunlap is Secy.-Treas. of Madison Construction Co., Edwardsville, Ill.



R. B. Dunlap

Charles Allen Tucker, Major with the 332nd Engineers, is on terminal leave prior to returning to his position as managing partner of the construction firm of Cook and Tucker, Ottawa, Kans. Major Tucker spent 40 months in the ETO.

W. W. Purdy, until recently Lt. Commander in the Seabees, has taken up his duties as partner and general manager of the Purdy Construction Co., Mansfield, Ohio.



W. W. Purdy

Thomas F. Crumley resumed his position as Vice President and assistant general manager of the Crumley, Jones & Crumley Co. on Nov. 29, 1945. Mr. Crumley served in Panama as Captain of Anti-Aircraft Artillery.

Frank F. Bell, Col., Corps of Engineers, returned in November to his duties as vice-president of Uvalde Construction Co., Dallas. He commanded the 373rd Engineer (G.S.) Regiment throughout its two years of existence. This regiment was decorated for opening the Porte of le Havre, and Col. Bell received the Bronze Star.

William N. Franklin, with corps of engineers, is back with the contracting firm bearing his name at Springfield, Ill.

G. J. Gill, Navy Lt. with the Pacific Fleet, has returned as general manager of J. B. Gill Co., contractors, Long Beach, Calif.



"Progress forgot my address..."

"I hear a man can fly half-way across the country nowadays in four hours.

Funny . . . it takes me almost that long sometimes to haul my crops twenty miles to the railroad siding. Nasty weather I can't get there at all—the road's that bad. Progress?

Sometimes I wonder . . ."

Maybe you've wondered, too, about the condition of America's country roads. These roads—2,400,000 miles of them—serve 6,000,000 farms. They link rural Americans with their schools, churches, markets, neighbors. Yet, more than half of them have no surfacing of any kind, and over one-third are still classed as *primitive*.

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(Continued from page 74)

above normal costs to users, and despite rising prices some construction should possibly go ahead.

Cost vs. Contract Size

O'Neale introduced the question of the most economical size of contracts. Contractors today are hesitant in bidding on big jobs that will run into 1947. Also large jobs limit competition in bidding and encourage subcontracting. He feels that contract sizes should be definitely limited. Breaking up big contracts will help more new small contractors to get into road work, he thinks.

The need for more contractors who have developed and expanded their

organizations was recognized. C. M. Hathaway of Illinois concurred with Mr. O'Neale, and raised the possibility of letting various project phases or items separately more often. He finds contractors more enthusiastic over jobs which can be cleaned up in 3 or 4 months, but thinks there should be no difficulty in having jobs of all sizes in a large program.

Bridges and Structures

A discussion on bridges under Mr. Archibald raised the question of standardized designs for secondary road bridges. The big problem is to keep bridges and structure costs down on low-cost roads, especially the 100-

car-a-day roads. Yet such bridges must usually be above high water and have footings below the scour line. Timber costs make temporary bridges nearly as costly as steel or concrete. One-way or ford-type crossings were discussed but no agreements reached. It was noted, however, that most bridge obsolescence today is due to lack of safe 2-lane width, and that the cost of additional width is not a great factor.

Minnesota's laws and design standards are being revised to make township bridges the responsibility of counties. Counties are demanding up-to-date standard plans, but lack of design personnel has hampered the state.

AGC-AASHO Committee

THE Oklahoma City conclave this winter included a notable session of the Joint Co-operative Committee of the AASHO and the Associated General Contractors. Fourteen members were present, W. W. Mack of Delaware, presiding as co-chairman. The recent meeting resulted in:

1. A resolution asking engineers to re-examine designs to eliminate refinements that possibly increase cost beyond their worth.

2. A resolution asking for elimination of detailed reports now required of contractors on Federal-aid highway work showing costs as well as quantities of materials.

Current regulations require contractors to submit several copies of all payrolls, and more recently, detailed costs on fifteen different items of materials and supplies. These requirements originate in Acts of Congress, under one of which the Bureau of Labor Statistics of the U. S. Department of Labor is empowered to gather certain information on all work involving federal funds.

Troublesome Reports

On behalf of the contractors, particular objection was raised against the recently expanded requirements as to reporting costs of materials. It was stated that the set-up for gathering this information is such that it could very easily fall into the hands of competitors. Since only a part of the cost elements that enter into the final total for any particular project is covered, this information may be used to give a distorted picture of the contractor's real costs. As a matter of fact some contractors because of their standing as businessmen have arrangements for preferred prices over

other competitors, and they seek to protect these sources.

It was stated that contractors have in the past voluntarily opened their records on many occasions for confidential examination by appropriate State highway department officials in order to furnish an intimate check of costs, and they will not object to this in the future. They feel, however, that the new reports required on material costs, making them public records, tends to weaken private enterprise.

3. Recognition of the vital importance of more uniform general provisions in specifications, as a means to better work at lower cost.

The Committee has never gone beyond the scope of the general provisions that constitute what may be called the "boiler-plate" of any set of specifications for highway work. These are the provisions that are of practically universal application throughout the whole country.

Just previous to the entry of the U.S.A. into World War II the Committee had completed the development of the following projects, both approved in 1941 by AASHO and AGC.

A. Standards of Qualification and Prequalification of contractors.

B. Specification for Determination and Extension of Contract Time.

With the return to peacetime conditions it was the consensus of opinion that this activity in regard to general provisions should be resumed. A resolution was approved suggesting that the AASHO Construction Committee revive its Sub-Committee on General Provisions to the end that additional uniform general provisions be developed in conjunction with the Joint Co-operative Committee.

Labor Problems

4. A discussion period was given to union labor. On highway construction, contractors generally have agreements with three basic unions, (1) operating engineers, (2) truck drivers, and (3) common laborers. Where controversies arise between the contractor and other unions, such as iron-workers, carpenters, etc., these latter may throw a picket line around his job. Members of the basic unions will often refuse to cross these picket lines, and the contractor will have to come to terms with the other unions.

Under organized labor conditions the contractor has very limited freedom in the selection of his labor. In some instances where he requests certain men, they are immediately marked down as "pets," and he doesn't get them.

The contractor is vitally interested in the control of working conditions that increase cost, "feather-bedding" practices that boost prices more than higher hourly wage rates. Contractors are worried about the saturation point of wages, the point where costs will mount so high the public will refuse to buy. When that point is reached the contractor goes out of business. While the officers of the international unions realize this danger, the same cannot be said of all local officers.

The case was cited of the use of granite on public buildings. Granite cutters were organized and this type of work largely controlled by them as far back as 1900. At that time and for a period later there was wide use of granite in outside walls, etc., but the price for granite in place pyramided. Today, use of granite in walls has been eliminated and it is confined mostly where used at all to entrance

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steps. Now there are very few granite cutters employed.

Postwar Labor Relations

5. The following data was presented on labor relations generally:

As matters stand today the treatment of servicemen, whether or not they are given preference, is largely a matter of local practice. Where labor is highly organized very little preference is being shown to them.

It is refreshing to note that the morale of returned servicemen, their willingness to do a job, referring particularly to those formerly engaged in construction, is better than that of the average worker now employed. Servicemen have not been subjected to the same conditions prevalent at home, especially in war plants—conditions that have reduced the efficiency of the war worker. On the other hand, however, for a long time they have been fed and clothed and housed, all their wants taken care of, and all decisions made for them. A state of affairs quite different than they now meet in civilian life. It is not to be wondered at, therefore, if in many cases, they show a loss of initiative and a lack of accountability.

Actual hiring of servicemen. Under current regulations, hiring men is initiated through the field offices of the U. S. Employment service. They furnish lists from which the contractor must pick his men. In areas where labor is highly organized this operates so that USES certifies only unionmen, and hence only those servicemen who are members of the union.

Airport Plan Approved

Committee leaders in Congress have reported out an agreement which provides for a 7-year airport program, involving \$500 million Federal-aid to be spent at a rate not to exceed \$100,000,000 in any one year. This plan represents a compromise over bills S-2 and H.R.-3615 which were stymied this past winter.

Federal-aid funds under this legislation would become available July 1, 1946, for the fiscal year 1947. \$3,000,000 is made available immediately for planning and surveys, and planning funds are to be matched. Moreover, \$20,000,000 has been allotted for airfields in Alaska (\$10 million), and \$5 million each for Hawaii and Puerto Rico.

Class III and smaller airports are to receive Federal-aid on the basis of 50-50 matching; Class IV and larger airfields are to receive Federal funds not to exceed 50 percent of their cost, due to high cost of large administration buildings.

Seventy-five percent of all Federal-aid will be allocated to the various

states on basis of a formula embracing population and area of a state in relation to all of the states. The agreement—still subject to approval by Congress as a whole—permits funds to be channelled through a state agency or through local communities direct. The balance (25%), shall be allocated for airports of all classes without regard to state boundaries or formula. Allocations will be made by the Administrator of CAA. Cost of property interest (land) is to be taken into account in computing Federal-aid. Cost of hangars is not to be taken into account, but reasonable cost of administration buildings will be considered in taking into account amount of Federal-aid which shall apply to a project. Thus, Federal-aid will not apply to hangars, but may apply to cost of land to the extent of 25%.

The Conference report provides that minimum wages shall be in effect on all contracts, and these wages shall be determined and fixed by the Secretary of Labor. No convict labor may be used; and veterans are to be given preference with exception of administrative and executive positions.

Construction is to be supervised and approved by CAA's Administrator, who is authorized to pay monthly estimates up to 100% of the cost of work done. None of the funds may be allocated for construction undertaken prior to enactment of the law, but a proportion of planning costs previously made may be included.

This agreement on the part of the House and Senate conferees marks an important step forward in providing ground facilities for aviation, and assures final passage of the bill, which is scheduled to be considered by Congress as a whole.

A city arterial Route Planning Bureau has been set up in the New York state department of public works. Fred W. Fisch of Schenectady and Edgar B. Shrope of Elmsmere, N. Y., have been appointed principal planning engineers.

Organize Institute for Local Highway Officials

The American Institute of Local Highway Administration, organized last January in Chicago at the convention of the American Road Builders' Association, took tangible form during March at a three-day session of the organization committee headed by Ed L. Almand of Atlanta, Ga. This organization which is to represent the local rural highway officials of the nation, under the auspices of ARBA's County Highway Officials' Division, has for its purpose the assembling,

dissemination and emphasizing of information of all types bearing on local rural highway administration. Judge Gilbert Smith of Anson, Texas, is president of AILHA.

The institute, made up of three members from each state delegated by state associations of local highway officials, is modelled along the beneficial lines of the American Association of State Highway Officials, but at the local administrative level. The committee has drafted a constitution and defined purposes and policies.

"I predict this association will offer our county executives the rallying ground they have so long needed," said Judge Smith. "Our deliberations will be presented to the institute at the earliest practicable date," he added.

Members of the organization committee present were Ed L. Almand, Atlanta, Georgia, (Chairman); Andrew L. Burrus, Union City, Tenn.; A. O. Cuthbert, Lansing, Mich.; D. Y. McDaniel, Waco, Texas; A. J. Thelen, Madison, Wis.; H. A. Thomson, Drexel Hill, Penn.

Record Traffic Volume in Prospect

Rural highway traffic during the coming summer will approach and may possibly exceed prewar levels, according to the Public Roads Administration of the Federal Works Agency. Last October, the traffic counts of State highway departments showed a marked upswing. In the following months, traffic continued its sharp rise above that in the same months of the war years. In January, traffic outside of cities, reached an all-time peak for that month, exceeding the 1941 figure by 6.9%.

The January increase over 1941 traffic was most marked in the Rocky Mountain and Pacific Coast States, amounting to 24%. In the central region it was 3.2% above the 1941 figure while the New England and North Atlantic States were still 1.6% below the prewar figure.

The increase in travel over that of 1941 was almost entirely on the main highways, but there was a small increase on the local roads. At the beginning of the year there were some 4,000,000 fewer passenger cars than in 1941. However, many drivers were finding less difficulty in obtaining repairs and the tire situation was improving. Much of the increase in travel was by returned veterans and released war workers.

During the summer months there is expected to be increased use of cars now in service and traffic will be swelled in proportion to the new cars placed in use.

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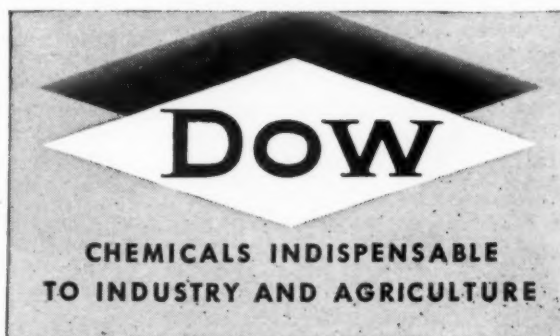
2-4 Dow Weed Killer is the tested product you've been reading about. Use it wherever weeds must go so grass can grow—lawns, parks, playgrounds, golf courses, cemeteries and airfields. And for better maintenance—along highways, railroads and utility lines. 2-4 Dow Weed Killer is available in both powder and liquid form. It comes conveniently packed in sizes for every need.

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Glycerine

How It Can Work for Your Shop

Glycerine can play a helpful role in the construction equipment maintenance shops. This is evident from the hints suggested by G. Leffingwell of the Glycerine Producers' Association

PRACTICALLY everyone knows glycerine to some extent, if only for its value as a radiator anti-freeze. Comparatively few, however, appreciate the wider possibilities which this valuable liquid offers and which may be advantageously utilized "somewhere along the line."

For Windshield and Goggles

Glycerine finds many important uses in glass care and maintenance and its usefulness applies equally to windows as to protective goggles. In order to get maximum visibility, glass must be kept clear and bright. One simple composition that will greatly facilitate this task is a glass cleaner made of:

Alcohol	45 parts
Water	45 parts
Glycerine	10 parts

In practice, too, it has been found that glycerine has a helpful function on the inside of windshields and windows as well. After washing, rub them over with a clean cloth dipped in a little glycerine and it will prevent steam from forming.

If goggles become clouded by mist or sweat, glycerine pencils can be used to relieve this fogging. One composition for making such glycerine pencils or crayons, said to be satisfactory for year round use, consists of:

Glycerine	325 parts
Sodium hydroxide (sticks).....	50 parts
Stearic acid	625 parts

Heat the glycerine to about 100° C., dissolve in the alkali and to this add the separately melted stearic acid stirring constantly. When the action stops, pour into molds.

A paste preparation for prevention of fogging consists of:

Potassium oleate	16 parts
Glycerine	8 parts
Spirit of turpentine.....	1 part

Mixing should be done on a water bath. If too thick, the product may be thinned by adding more glycerine.

When Painting Around Glass, Tile or Metal

When painting, glass surfaces may be protected if the following masking coating is applied:

Kaolin	2.0 parts
Glycerine	1.5 parts
Water	4.5 parts
Butyl alcohol	0.25 part

Mix these ingredients thoroughly and apply to the glass with a brush. After painting the mask may be readily removed with a putty knife, a cloth or by simply washing with water. Of course, the same masking mixture may be used when painting to protect tile, metal, or other impervious surfaces where dried paint is difficult to remove. This masking material is especially valuable when spray painting.

Belt Dressing to Eliminate Static

Glycerine is used in making tested and approved leather belt dressings that are said not only to dissipate static as fast as it is generated, but also to preserve the leather and make the belt soft, pliable and increase its life. The ingredients are the same as those recommended by the U. S. Department of Agriculture and the quantities specified will make about one quart of dressing:

Fish glue	9 oz.
Glycerine	7 oz.
Sulfonated castor oil.....	7 oz.
Water	12 oz.
Lampblack	6 oz.
Ammonia water, 2%.....	2 oz.

The glue and the glycerine are first heated together for two hours at a temperature at which the mixture barely boils, stirring frequently. Stir the other ingredients, in the order given, into this warm mixture. When finished keep in a closed container.

In this dressing, the lampblack acts as the electrical conductor. The 2 oz. of 2% ammonia needed can be prepared by adding ¼ oz. of ordinary household ammonia to 1¼ oz. of water. While the belt is running, the dressing may be applied to the side that bears against the pulleys. Weekly applications are said to be usually sufficient to keep dangerous static down to a negligible amount.

For Leather Belting Cement

Glycerine enters extensively into items for maintaining and repairing leather products. A typical case in point is the following leather belting cement or glue:

Gelatin	50 parts
Glycerine	5 parts
Turpentine	10 parts
Linseed oil varnish.....	5 parts

Soak the gelatin in water, pour off the excess and heat on a water bath. With constant stirring, add the other ingredients. Thin with water as required.

To use, the ends of the belt to be glued are cut obliquely and warmed. The glue is then applied hot and the joined parts are put under pressure, and so allowed to dry for 24 hours before the belt is to be used.

For General Repair

Glycerine-litharge cements have an almost infinite number of installation, maintenance and repair uses. These cements may be employed for repairing leaks and cracks in pipes, pans, tanks and boilers; for sealing pipe joints; for stopping leaks at flanged joints; for insulating soldering irons; for repairing tool handles by setting the tools firmly; for setting glass and glass boiler indicator tubes; for anchoring screws, studs, bolts, etc., in masonry, ceramic materials or wood; for holding screws and for filling screw and bolt holes on metal, wood

or ceramic equipment.

It is prepared by simply mixing glycerine with powdered litharge (lead oxide) to form a pasty mass of the required consistency, these cements set rapidly to form bonds of tremendous strength, hardness, toughness and resistance. The glycerine cements are known for their ability to withstand vibration, heat, moisture, steam, dilute acids and other deleterious substances.

Since the cements set very rapidly, sometimes in only a few minutes, only as much glycerine and litharge should be mixed as is immediately re-

quired, and tools and mixing vessels should be cleaned as soon as the work is finished. Addition of water hastens the setting time and influences the general characteristics of the cements to some extent. The addition of up to ten per cent of inert fillers (e.g., silica, Fuller's earth, iron oxide or whiting) also slows the rate of setting, but without impairing the final hardness and strength. If desired, these glycerine-litharge mixtures may be colored by the addition of suitable coloring materials during mixing, or the hardened cement may be painted since coatings adhere well.

Facing the Facts about Hard-Facing

The object of this article, prepared by Mir-O-Col Alloy Company, is to review and explain the general principles employed in the field of hard-facing

HARD-FACING is the process of depositing a metallic compound, which is exceedingly resistant to abrasion or corrosion, to the wearing surfaces of metal which is softer or with lesser wearing characteristics.

Types of Wear

Abrasion: Grinding action caused by abrasive solids sliding, rolling or rubbing against the surface of wearing surfaces.

Impact: Repeated blows or check which wear or deform wearing surfaces.

Galling: Adhesion of two bearing surfaces of metal followed by the tearing out of small fragments of one or the other surfaces.

Corrosion: Oxidation or other chemical actions to which metallics are subjected by liquids, salts or heat.

Erosion: Scouring action of liquids or gases or vapors traveling at high velocities against the wearing surfaces of metal.

No one type of hard-facing is satisfactory and economical for all applications. To meet the various kinds of wear encountered in various branches of industries, many hard-facing materials and alloys have been developed.

Types of Alloys

For the purpose of identification, these alloys may be classified into the following four groups:

1. **Ferrous alloys group with less than 20% alloys and the remainder iron:** The alloying elements in this type of material consist usually of chromium, tungsten, manganese, silicon and carbon. These alloys have a hardness range of about 35 to 62 Rockwell. Many of these materials are machinable and forgeable.

2. **Ferrous alloy group with over 20% alloys and the balance iron:** The alloys consist of chromium, nickel, carbon, molybdenum, boron, silicon and manganese. Some of this group will retain their hardness at red heat. The hardness will run from 40 to 62 Rockwell. Most of this group are unmachinable and must be ground if a finish is desired.

3. **Non-ferrous Group Alloy:** This type of alloy has very little or no iron in it, being comprised mostly of nickel, cobalt, chromium, tungsten and molybdenum. Most of these alloys are able to hold their hardness at red heat. They are more brittle and will stand less impact than the ferrous alloys.

Diamond Substitutes

4. **Diamond Substitutes Group.** This group is composed of carbides of tungsten, tantalum, titanium and boron and borides of chromium. Sometimes there is a small amount of cobalt, nickel or iron added to the inserts to increase their toughness. If in a rod form, the carbide material may be either in a cast form or enclosed in a mild steel tube. The carbide group is the most resistant to abrasion of all hard-facing materials, although it does not compare with the ferrous alloy group so far as withstanding impact and shock. This type of hard-facing material is manufactured in three forms, insert, rod and powder. The deposit of the above group is very rough and this of course limits its uses. On many jobs, a smooth deposit is necessary. The deposit of ferrous alloy rod may be either Martensitic or Austenitic; i.e., the deposited state of the metal may be Martensitic and as hard as it will ever become, or it may be Austenitic with a fairly soft deposition state and work-hardening under impact and deformation. This last type is sometimes called "self-hardening."

Characteristics of Hard-Facing Deposits

Deposit Desired	Group Number
Cold hardness	4-(2 & 3)-1
Red hardness	4-(3 & 2)-1
Impact	1-2-3-4
Corrosion and erosion	3-2-1-4
Smoothness	3-1-2-4
Thinness	3-2-1-4

Examples for use of above table: Crusher jaws or drag-line dipper teeth which are subjected to terrific shock and impact would call for the use of Group No. 1, as hardness is secondary and toughness is primary in this case.

Valves that work under extremely high temperatures and must resist corrosion and erosion would call for Group No. 3, due to this alloy's ability to hold up under both corrosion and its red hardness characteristic.

The extremely high hardness of Group No. 4, combined with the rough deposit which helps increase the part's cutting action, make this one of the most popular for use on oil well drilling bits, and certain types of earth moving and mining equipment.

The engineer who is consulted concerning the correct type of hard-facing to use on the job in question must not only know what the equipment or part is and the kind of steel it is made of, but what is more important, he must know exactly what is going to be required to accomplish; in other words, he must not recommend an Austenitic or "Self-hardening" rod to be used on earth moving equipment, that is moving soft earth. Due to the lack of impact or shock, it would never work harden, therefore, it would quickly wear away. On the other hand, if the equipment in question were being used to move rocky material, the tungsten carbide group would be unsuitable as it would tend to crack or spall off.

Important Test Findings

The following tests were made and conclusions drawn by T. B. Jefferson (Editor of *Welding Engineer*) while Engineer, Marine Design Section, Chief of Engineers, U. S. Navy. The conclusions reached apply only to the hard-facing field in general and not to any one rod in particular.

1. Hard-facing materials deposited on surfaces which have been pre-heated will be harder than those made on cold base metal surfaces.

2. Deposits made with either the oxy-acetylene or metallic arc process will exhibit higher hardness properties than those made by the carbon arc process.

3. The metallic arc process is most satisfactory from the standpoint of speed of deposition.

4. Hard-facing deposits for maximum hardness should be made using

the longest acetylene cone in the flame that will produce a satisfactory deposit under the existing conditions.

5. The hardness of the deposit may be increased by "hot-peening" (2 or 3 points Rockwell) (Austenitic Type, Group No. 1 only).

6. A carburizing flame will melt the base metal more rapidly than a neutral or oxidizing flame.

7. The Brinell or Rockwell hardness number is not necessarily an index to the wear resistant properties of a hard-facing deposit.

With the exception of a very few makes, hard-facing material may be finished only by hot-knifing, hot-filing or grinding. The proper speeds and types of wheels must be used, otherwise grinding checks may result.

The majority of all steels are capable of being hard-faced with the exception of certain high vanadium and high speed tool steels, also copper and copper alloys such as bronze and brass.

How to Make Brake Linings Last Longer

(Johns-Manville Sales Corp.)

1. *The capacity of any clutch or brake is its ability to dissipate heat.* Heat is best disposed of by convection—take every possible means of increasing air flow around clutches and brakes to get rid of heat.

2. *Guard against high temperature in brakes or clutches as it may cause:*

- Wide variation in friction.
- Rapid wear of friction material.
- Possible scoring of metal surface.
- Possible heat checking of metal surface.

e. Failure of bearings.

3. *Do not use oil, clay or other foreign substances on friction material surfaces in order to control friction.* Widely fluctuating brake action will result and probably necessitate lining replacement.

4. *Be sure brakes and clutches are properly adjusted.* Unequal adjustment causes unequal wear and inefficient and noisy operation.

5. *True up badly scored or heat-checked rims with whetstone if portable grinders or other equipment are not available.* Rims in this condition can cause rapid wear of friction materials.

6. *Check bands for being out of round or kinked when relining.* Such conditions create local high pressure areas, rapid wear, excessive heating, noisy operation and short life.

7. *Bear in mind that increasing the width of a brake does not increase its braking capacity.* It simply reduces

unit pressure and the brake lining lasts longer.

8. *Greater brake capacity can be provided by increasing diameters or torque arm, or total pressure.*

Underground Parking Garages

The city of Detroit, Mich., soon will have an underground parking garage. Voters in the municipal elections last fall approved a bond issue to finance the construction of a \$2,000,000 garage, with space for approximately 1,000 cars, under Washington boulevard, almost in the heart of the central business area. The garage will be two stories underground, and will extend from Grand Circus Park to Grand River Avenue. Authorities estimate that the garage will pay for itself in 18 years on parking fees averaging 30c a car. It will be operated as a private enterprise by a group of Detroit merchants and businessmen who have organized as Washington Boulevard Underground Parking, Inc.

San Francisco, Calif., was probably the first large city to go underground for parking space. A 4-story parking garage in which 1,700 cars can be parked at one time was opened in 1942. The garage has more than paid its way, even under wartime conditions.

Highway Traffic This Summer May Exceed Pre-war Levels

Rural highway traffic during the coming summer will approach and may possibly exceed prewar levels, according to the Public Roads Administration. Last October the traffic counts of state highway departments showed a marked upswing. In the following months traffic continued its sharp rise above that in the same months of the war years. In January traffic outside of cities reached an all-time peak for that month, exceeding the 1941 figure by 6.9%.

The January increase over 1941 traffic was most marked in the Rocky Mountain and Pacific Coast states, amounting to 24%. In the central region it was 3.2% above the 1941 figure while the New England and North Atlantic States were still 1.6% below the prewar figure.

The increase in travel over that of 1941 was almost entirely on the main highways, but there was a small increase on the local roads.

Blocks and Tackle

The following data on this important subject are published with permission from "THE LINE" issued by Line Material Company

Block and tackle arrangements are one of the common tools employed by construction men. With the proper combination of rope and blocks many heavy jobs can be easily done.

The terms which are common to blocks and their use are as follows:

Block—See Fig. 1 for names of parts.

Reeving—The operation of passing the rope around the sheaves.

Standing End—The rope end which fastens to the becket or to the load if only a single block (or whip) is being used.

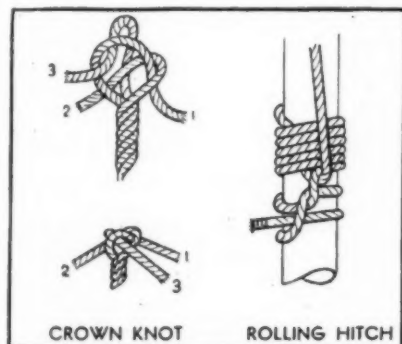
Running End—The rope end which is loose or the fall of the rope.

Overhaul—To separate blocks.

Round In—To bring blocks close together.

Chocablock—When blocks are tight together.

Size of Block—Length of shell in inches together with the number of sheaves such as: single, double, triple, or quadruple blocks.



Blocks are used to change direction of ropes and to give power at the expense of distance. The advantage is the reduced power needed to lift or pull a given load. The mechanical advantage of one double and one single block (3 sheaves altogether) is 3, of two double blocks 4, one double and one triple 5, etc. However, the sheaves and the bending of the ropes create friction and therefore the full mechanical advantage is not obtained. The friction for each sheave can be taken as approximately 10% and the load necessary to pull a given

load figured as shown by the following example:

Example: Load to be lifted — 200 lbs.
Tackle, one single and one double block.

$$\frac{200 \text{ lbs. (Load)}}{3 \times .90 \times .90 \times .90} = 91.44 \text{ lbs. pull}$$

(Number of sheaves) (Efficiency of each sheave)*

*The figure .90 is used as many times as there are sheaves in the tackle.

It may not always be desirable to obtain a large mechanical advantage because the larger the advantage the greater the distance the running end of the rope must be moved through.

Use blocks as large as the job requires, too small a block bends the rope too sharply and too large a rope causes excessive friction on the sheaves and blocks. The proper size rope for different blocks is given in table.

TABLE

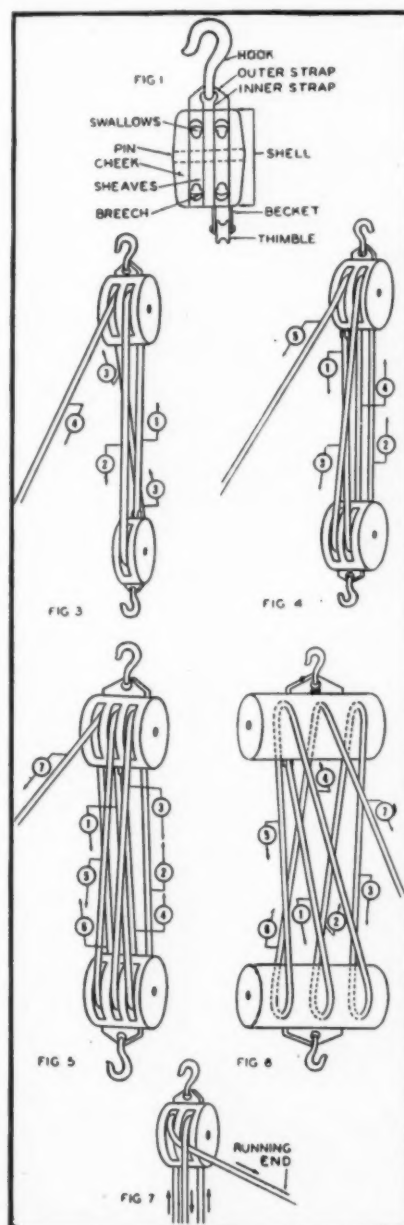
Size of Block	Rope Diam.	Size of Block	Rope Diam.
3"	3/4"	9"	1"
4"	1"	10"	1 1/4"
5"	1 1/4"	12"	1 1/2"
6"	1 1/2"	14"	1 3/4"
7"	1 3/4"	15"	1 7/8"
8"	2"	16"	2"

Figs. 3, 4 and 5 show the common method of reeving different sets of blocks. Fig. 6 shows a diagram of reeving a set of triple blocks which brings the running end of rope out the center sheave. This method requires the lower block to be one-quarter turn from the upper to clear ropes. Such reeving, when it can be used, prevents tipping of the blocks which is encountered when reeved according to Fig. 5. However, either method can be used wherever it applies best.

Minimum Breaking Strength of Rope in Pounds

Rope Diam. (Nominal Ins.)	Manila (100%)	Sisal (75% of Manila)	Pure Jute (60% of Manila)	Mixed Jute (54% of Manila)
3/4"	1,350	1,012	810	729
7/8"	1,750	1,312	1,050	945
1 1/8"	2,250	1,687	1,350	1,215
1 1/4"	2,650	1,987	1,590	1,431
1 3/8"	3,450	2,587	2,070	1,863
1 1/2"	4,400	3,300	2,640	2,376
1 5/8"	5,400	4,050	3,240	2,916
1 3/4"	6,500	4,875	3,900	3,510
1 7/8"	7,700	5,775	4,620	4,158
2"	9,000	6,750	5,400	4,860
2 1/8"	10,500	7,875	6,300	5,670
2 1/4"	12,000	9,000	7,200	6,480
2 3/8"	13,500	10,125	8,100	7,290
2 1/2"	15,000	11,250	9,000	8,100
2 5/8"	16,500	12,375	9,900	8,910
2 3/4"	18,000	13,500	10,800	9,720
2 7/8"	19,500	14,625	11,700	10,530
3"	21,000	15,750	12,600	11,340
3 1/8"	22,500	16,875	13,500	12,150
3 1/4"	24,000	18,000	14,400	12,960
3 3/8"	25,500	19,125	15,300	13,770
3 1/2"	27,000	20,250	16,200	14,580

When it is desired to hold a load in a steady position for a length of time the rope is generally secured in some fashion. Sometimes there is no place to fasten the running end of rope. A simple and convenient way to fasten the blocks for such a case is to jam the running end of rope between the rope in the adjacent sheave and the block shell as shown in Fig. 7.



New Officers and Directors of ARBA'S Airport Division

Officers and directors of the Airport Division of the American Road Builders' Association were announced by the division's president, Major General Julian L. Schley, USA (retired). This group which is concerned with the engineering design, construction and maintenance of airports was reorganized last autumn and is rapidly growing under the direction of Walter R. Macatee, manager. The nominations, confirmed at January convention, are:

President: Major General Julian L. Schley, US Army (retired), Executive Director, Baltimore City Aviation Commission.

Vice Presidents: William E. Cullinan, Director, Bureau of Aviation, New York Department of Commerce, Albany; Dexter C. Martin, Director of Aeronautics, South Carolina Aeronautics Commission, Columbia; L. L. Schroeder, Commissioner, Minnesota Department of Aeronautics, St. Paul; O. J. Porter, Engineer, Materials and Research Section, California Division of Highways, Sacramento.

Directors (1946): George E. Martin, Cons. Engr., Paving Materials Sales, Barrett Division, Allied Chemical & Dye Corp., New York; Wayne Parks, Mgr., Jefferson County Airport, Beaumont, Tex.; *George W. Roseberry, Chief Engr., Board of Park Commissioners, Wichita, Kan.; Major Clarence F. Cornish, Dir., Aeronautics Commission of Indiana, Indianapolis; Major John Berry, Comm'r of Airports, Cleveland; Robb C. Oertel, Mgr., Aviation Division, Sales Dept., Standard Oil Co. (N. J.), New York; *Thomas C. Imeson, Chairman, City Commissioners (Streets and Airports), Jacksonville, Fla.

Directors (through 1947): A. A. Anderson, Mgr., Highways and Municipal Bureau, Portland Cement Association, Chicago; J. Kirk Baldwin, Gen. Manager, The Airport Directory, New York; Captain Rufus C. Phillips, Jr., Pres., Airways Engineering Consultants, Inc., Washington, D. C.; Colonel Floyd E. Evans, Dir., Michigan Dept. of Aeronautics, Lansing; Wayne E. Parrish, Editor & Publisher, "American Aviation," Washington; Hervey F. Law, Airport Administrator, Washington National Airport, CAA, Washington, D. C.; Arthur H. Benedict, Dist. Engr., Asphalt Institute, Los Angeles, Calif.

Directors (through 1948): W. H. Cullimore, Airports Engr., State

*Formal acceptance of nomination not received up to 3-27-46.

Aviation Commission of Maryland, Baltimore; *Gordon C. Sleeper, Sales Mgr., Personal Plane Division, Republic Aviation Corp., Farmingdale, N. Y.; E. W. Bauman, exec. Sec., Toncan Culvert Manufacturers' Association, Cleveland; *Elmer Haslett, Dir. of Airports, Department of Marine & Aviation, New York City; T. M. Deal, Pres., Link-Belt Speeder Corp., Cedar Rapids, Ia.; Major H. H. Allen, Senior Partner, J. E. Greiner Co., Consulting Engineers, Baltimore; W. L. Kirkland, President, Warren Brothers Co., Cambridge, Mass.

Milwaukee's "Doorstep" Airport

Civil Aeronautics Administration officials are watching with deep interest the pioneering activity of the city of Milwaukee in establishing the first "downtown" airplane facilities in any metropolitan area.

Established in September, the landing area located on Lake Michigan frontage a few hundred yards from the business district is 3,000 ft. long and 500 ft. wide while the turfed strip is 3,000x100 ft.

Sponsored by the city through the activities of the progressive Milwaukee Citizens Committee on Aviation, the airport is operated under private management by A. C. Lang, a commercial operator. In spite of winter weather there have been considerable air operations by commuters, transients and businessmen who use private air transportation to meet their engagements.

Location of the strip, according to Francis J. Trecker, chairman of the Milwaukee committee, enables it to utilize the already established seaplane landing ramp and thus provide two-fold air facilities.

New Testing and Research Lab for New York

Plans are progressing for the construction and operation of a new testing and research laboratory for the New York state department of public works on the campus of Syracuse University, according to Charles H. Sells, superintendent of public works. The new laboratory will replace presently inadequate facilities in Albany. The new structure will house physical, chemical, concrete and soil testing laboratories, machine shop and freezing and thawing equipment

as well as necessary office facilities to implement its efficient operation. The building will be so designed as to make possible future additions to provide research and testing facilities for other units of the State government as well as for investigations leading toward the development of additional methods for greater utilization of the State's natural resources and products.

The organization and operation of the new laboratories will be such as to make the facilities available to the various municipalities and other local civil units of the State on a recompensable basis. The plant will be situated on a 35-acre tract of land of the University campus and will be jointly operated by the State and Syracuse University.

The decision to locate the laboratories on a college site, said Mr. Sells, was predicated on the principles of efficiency and economy. By joint operation, he said, the State will obtain the services of trained research experts on the University faculty and will also have available for State use certain college equipment already on hand and necessary for the efficient operation of the laboratories. It will also tend to largely eliminate the problem of employment of seasonal workers during peak periods.

Funds granted include \$450,000 for building, service connections, grounds, etc., \$115,000 for new equipment, and \$200,000 for soils laboratory equipment, part of which will be assigned to field laboratories functioning under the direction of the central unit in Syracuse. Overall floor space will be 39,240 sq. ft.

Minnesota Highway Dep't 40 Years Old

The Minnesota Department of Highways celebrated its 40th anniversary on Jan. 12. On that date in 1906 the new three-man state highway commission held its first meeting.

The first state-aid allotment, made in 1907, averaged less than \$650 per county. The state-aid tax was increased to ¼ mill in 1911 and 1 mill in 1913. Federal-aid was first authorized in 1916 and channeled through state highway departments.

The Highway Commission had only supervisory power until the trunk highway amendment was adopted in 1920. This gave the state direct responsibility for improving and maintaining 7,000 miles of main routes, and initiated motor vehicle taxation for highway purposes. Taxing gasoline for trunk highway purposes was authorized by constitutional amend-

ment in 1924. The trunk highway system was enlarged in 1933.

Members of the first State Highway Commission were J. B. Galarneault of Aitkin, Charles Halvorsen of Dawson and Gustave Scholle of St. Paul. Later members included Louis W. Hill, St. Paul; Timothy O'Connor, Renville; C. I. McNair, Cloquet; Charles M. Babcock, Elk River; F. S. Bell, Winona, and F. B. Lynch, St. Paul. George W. Cooley of Minneapolis served as chief engineer throughout the life of the Commission.

The three-man commission was abolished in 1917 and the office of commissioner of highways created. Charles M. Babcock served as commissioner from 1917 to the end of 1932, N. W. Elsberg of Minneapolis, from 1933 to 1938, and M. J. Hoffmann of St. Paul, has served since January, 1939.

Dr. Terzakhli Awarded Brown Medal. The 1946 winner of the Brown Medal of The Franklin Institute is Dr. Karl Terzakhli, consulting engineer, lecturer on Soil Mechanics in the Graduate School of Engineering, Harvard University, and research consultant to the University of Illinois. He will receive the reward "in consideration of his theoretical and technical knowledge, initiative, pioneering research and outstanding leadership in the establishment of the Science of Soil Mechanics."

Major General Philip B. Fleming, Federal Works Administrator, and Commissioner Thomas H. MacDonald, of the Public Roads Administration, have been invited by the Government of India to advise that country in connection with a long-range highway expansion program. Following their visit to India, planned for this spring, they expect to go to Manila to look into the highway development program in the Philippine Islands.

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Indiana Roadside Council Requests Research Program

Purdue University may carry out a roadside improvement research program if the resolution adopted by the Indiana Roadside Council receives favorable action in the State Legislature. Included in the project would be studies of shoulder stabilization and the establishment of turf.

The famous Pikes Peak auto road, climbing from 7000 to 14,109 ft. elevation in a distance of twelve miles, is to be repaired and opened in June after wartime shutdown.

The Ohio state department of highways is said to be considering the purchase of two planes from army surplus, and has hired an engineer with army and commercial pilot experience to be available for plane operation.



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OTC PUSH-PULLER removing rear wheel spindle on the Diesel No. 12 Motor Grader by pushing it through bearing. Savings in costly parts, labor and "lay-up" time on jobs soon pay for OTC TOOLS.

NEW EQUIPMENT AND MATERIALS

Mail Inserted Card

for data on equipment
described on these pages

Postwar Parade

of New Construction Equipment and Materials

New Portable Air Compressors

1. A completely new line of portable air compressors known as the Air-master series has been announced by Le Roi Co., Milwaukee, Wis. There are 10 models—60 to 315 Le Roi gasoline engine powered and 105 to 500 full, 4-cycle Diesel-powered. Featuring many new and exclusive design features, emphasis has been directed toward functional utility. Full-length, built-in, hinged doors, lockable tool boxes are standard on all models as



New Le Roi Air Compressor

is push button electric starting. The patented Le Roi Econotrol, a simplified, automatic, speed-pressure governor, makes its first general appearance in the Airmaster series. A wide range of mountings are available. All wheel mountings are spring mounted with automotive steering on four-wheel machines. Skid, two-wheel (with third wheel caster), and truck mountings are available.

Slide Rule for Culvert Design

2. A useful slide rule for determining the hydraulic properties of pipe culverts has been designed by Dean F. T.

Mavis of Carnegie Institute of Technology, and copyrighted by M. W. Loving, Consulting Engineer, Chicago, Ill. In designing this slide rule, Dr. Mavis has assembled for mechanical computation, the several variable factors required to design short pipe lines or culverts to discharge water through highway and railroad fills. The hydraulic properties of culverts, ranging in diameter from 18 to 96 in. constructed on slopes from .01 to 4% can be easily determined. This is believed to be the first time this complicated subject has been presented in such a simple manner as to be helpful to engineers charged with the design and construction of culverts for highways and railroads. The slide rules are being distributed to practicing engineers by manufacturers of concrete pipe throughout the United States and Canada.

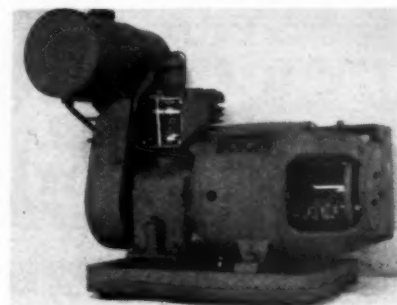
New 2-Unit Rock and Gravel Plant

3. A new 2-unit high capacity plant, completely portable, flexible, and light enough in weight to pass state highway limits, has been announced by Pioneer Engineering Works, Minneapolis, Minn. Two units are provided for each plant set-up; a primary unit and a secondary unit. In each type set-up, that is for rock or for gravel, the secondary unit remains the same but the primary unit is different. For gravel, the primary unit includes a feeder conveyor, a scalping screen, a primary jaw crusher and a power unit, all mounted on a 3-axle truck. This is a complete, self-contained unit with mechanical feeder and shovel hopper. For rock, the primary unit includes an apron feeder, a primary jaw crusher and a power unit, all mounted on a 3-

axle truck. The secondary unit for both types of set-up includes a feeder conveyor, a 4 ft. by 10 ft. vibrating screen, a 40 in. by 22 in. roll crusher, a return conveyor and a power unit, all mounted on a 3-axle truck. Three options are available in the primary jaw crusher, namely, a size 10 in. x 36 in., a 15 in. x 36 in., or a size 20 in. x 36 in. But little effort is required to change over from rock to gravel or from gravel to rock. Further flexibility is provided in the gravel primary unit because a swivel conveyor can be added and the mechanical feeder and hopper be moved to the receiving end of the swivel conveyor.

New Battery Charger

4. A new model battery charging engine set has been added to the line of Kato Engineering Co., Mankato, Minn. The set is powered by a Briggs & Stratton N P engine. The generator is bolted to side of engine crankcase. Drive end of armature is piloted on to engine crankshaft. Grease



6-Volt Battery Charger

sealed ball bearing carries outer end of armature. On 6-volts this charger will charge a maximum of about 80 amperes. The commutator is of generous length permitting extra large

dual brushes. There are four sets of brushes with two all-brass brush holders on each stud. Extra heavy conductors and large terminals to permit handling the large volume of current with low voltage drop. Each set is provided with starting switch, ammeter, and reverse current relay. Commutator and brushes are easily accessible by removing spun metal covering. This charger is also available for 12 and 32-volts.

New 3½ S Mixer

5. A new Rex end discharge 3½ S tilting mixer has been brought out by Chain Belt Co., Milwaukee, Wis. It weighs 150 lb. less than the former side discharge model and its wheel tread has been increased to 62 in. A



New 3½ S End Discharge Mixer

lower center of gravity has been obtained by cradling the mixer body between the wheels. Other features include a choice of two engine sizes—an enclosed roller chain motor-drum drive—an all-welded pressed steel drum bowl—a ring gear driving the drum that can be easily replaced when wear occurs . . . a large size (24 in.) control handwheel equipped with a safe ratchet-type lock—cantilever springs and a removable tow pole.

Improved Electrodes for Hard-Facing

6. One new and one improved shielded arc electrodes, each of the type designed for specific hard-facing applications, have been announced by the Lincoln Electric Co., Cleveland, O. "Abrasoweld AC," designated as a hard-facing shielded arc electrode, is designed for building up straight carbon steel, low alloy steel or high manganese steel with a self-hardening deposit to resist severe abrasion, bat-

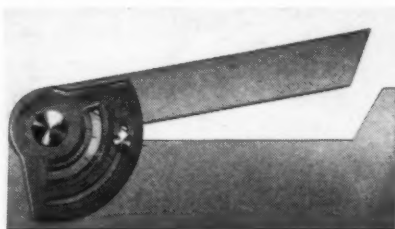
tering and impact. "Manganweld A," suspended for the duration, has been improved and is now manufactured specially for reclaiming worn austenitic manganese steel parts containing 11% to 14% manganese.

New Unit for Maintaining Battery Charge

7. A device known as the truck battery PowR SavR, a unit designed to maintain battery charge, has been announced by the Goodyear Tire & Rubber Co. Operators of trucks, particularly those using heavy duty equipment, often encounter difficulty in obtaining new batteries. Either dealers do not have the type of battery required or the need for them arises when dealer stocks are not accessible. The truck battery PowR SavR is stated to be the answer to truckers' vital problem—that of keeping spare batteries on hand and at peak efficiency, without deterioration from sulphation. The device provides trickle-charge maintenance, keeps batteries factory fresh. The rack is designed to carry four 12-volt batteries or eight 6-volt batteries, sufficient stock for the operator with a fleet of 25 trucks.

New Drafting Tool

8. An adjustable quadrangle combining many drafting features not usually available in one instrument has been announced by Stewart-Jackson Co., Los Angeles, Calif. This new plastic drafting tool has angles from 0° to 90°; pitch scales from 0 to 24/12; percentage slopes from 0% to 100%; sine or cosine functions and tangents may be found with the

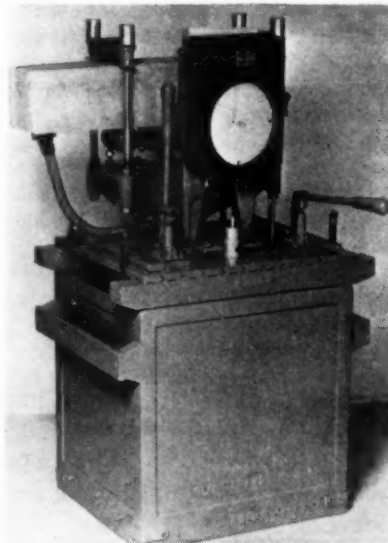


S & J Quadrangle

quadrangle. This instrument has eight drawing edges, is rectangular in shape, and may be used as a triangle. The overall size is 4 in. by 11 in., the body and arm of the instrument blank so the owner may add his own most-used cut-out symbols and measuring scale.

New Concrete Beam Breaker

9. A new model hydraulic concrete beam breaker which accurately produces a valuable chart record of the complete loading cycle has been added to the line of Rainhart Co., 602 West 34th St., Austin, Tex. The breakers perform within 1% over-



Front View of Breaker in Operation; Mounted on Its Shipping Case

all accuracy in normal temperatures, for both the "third-point" and the "center-point" concrete flexural strength tests according to ASTM and other specifications. Shockless, hydraulic loads up to 12,000 lb. are easily applied to an 18 in. span of either a single or double break length concrete beam with cross-section up to 6 5/16 in. x 6 5/16 in. through self-adjusting plates accurately positioned on knife-edges. Each chart bears a readily followed track so that even semi-skilled personnel can apply uniform loads and satisfactorily perform complete tests.

Larger Tires for Carryall Scrapers

10. Latest construction equipment development to be announced by R. G. LeTourneau, Inc., of Peoria, Ill., is the equipping of its Tournapull-drawn LP Carryall scrapers with 21.00 x 24 tires. Up to now this scraper unit carried 18.00 x 24 tires because the scarcity of rubber and other wartime conditions prevented an earlier change to the larger size tire. While the former size was considered adequate, use of the new larger tire is stated to have resulted in many added advantages. Maximum loads can now be

transported with lower pressure in the tires. Flotation contact area of the new tire is 24% greater than the old—373 sq. in. as compared to 300 sq. in., at rated pressures of 40 and 50 lb., respectively. This change to larger tires has increased scraper clearance approximately 4 in. over that obtained with the smaller ones. Through the standardization of Tournapull and Carryall scraper tire equipment, tire utility has been considerably increased. Interchangeability between front and back tires is now possible—worn traction tires being exchangeable with scraper trailing tires. A similar tread is used for both traction and trailing purposes—the former installed with tread open to the rear, and the latter with tread open to the front. Use of the 21.00 x 24 tire on the units of the rubber-tired LeTourneau line—Tournatrailer, Tournacrane, etc.—will result in similar advantages.

New Tracing Reproduction Machine

11. A new dry direct process machine that produces whiteprints in one continuous operation at a speed of 30 ft.

per minute has been placed in production by C. F. Pease Co., Chicago, Ill. Mechanical speed control of the machine is stated to be instantaneous and positive. Maximum printing speed



New Tracing Reproduction Machine

is assured by ingeniously locating within the contact cylinder a 75 watt per inch high pressure mercury tube which not only produces the proper type of light for rapid printing but

emits the light in an even flow over the full width of the tube. An alzak reflector, to utilize maximum light value produced, also serves as a variable light shutter for controlling the printing speed. An outstanding feature of this cylinder printer is the optional use of revolving or sliding contact, an exclusive Pease patent. The advantages of both methods of contact—sliding and revolving—are now available. The contact cylinder is cooled, through an original method, by the same blower which forms the vacuum to convey exposed prints to the ammonia fume developer. After exposure the tracings are stacked in a receiving tray after falling easily and naturally onto the tape conveyor. Tracings are never confined to close quarters, sharp bends, etc., which injure the edges.

New Refuse Collector

12. A new, all-enclosed refuse collector, called the Bucket Loader, has been placed in production by Gar Wood Industries, Inc., Detroit, Mich. The all-steel, all-welded body comes in two sizes: either 6½ or 8½ cu. yd. The body is supplied with the well-

"OUTLAW" ROAD SURFACE BREAKUPS



This state's highway subdrainage program was speeded and simplified by use of long lengths of sturdy, flexible perforated pipe.

Until 1940, pavement breakups were as "reg'lar as ground-hog day" each spring on certain New England highways. Then state engineers went into action with a thorough subdrainage program. Today that work is paying off in firm, smooth pavements, less maintenance work, reduced costs. A vital factor was—and is—perforated metal pipe that intercepts ground water in the trouble spots. They keep pavement foundations stable and firm.

You can "outlaw" costly breakups the same way with ARMCO Perforated Pipe. Installation is easy and fast, and costs are low—thanks to the long pipe lengths, fewer joints, light weight, and freedom from breakage. Once in the ground, ARMCO Perforated Pipe has the flexible strength needed to resist traffic weight and impact, vibration and disjoints. Perforations instead of open joints reduce the hazards of clogging.

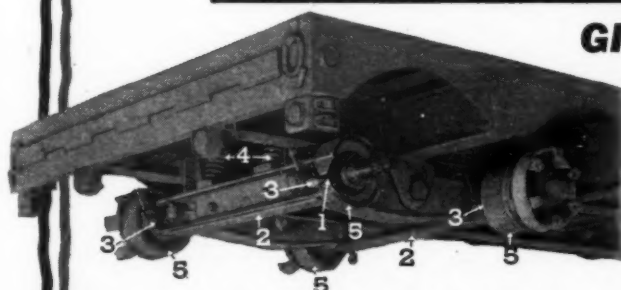
Remember that good drainage is costly only when omitted. Write us for literature on Designed Subdrainage. Armco Drainage & Metal Products, Inc., and Associated Companies, 785 Curtis Street, Middletown, Ohio.

ARMCO Perforated Pipe



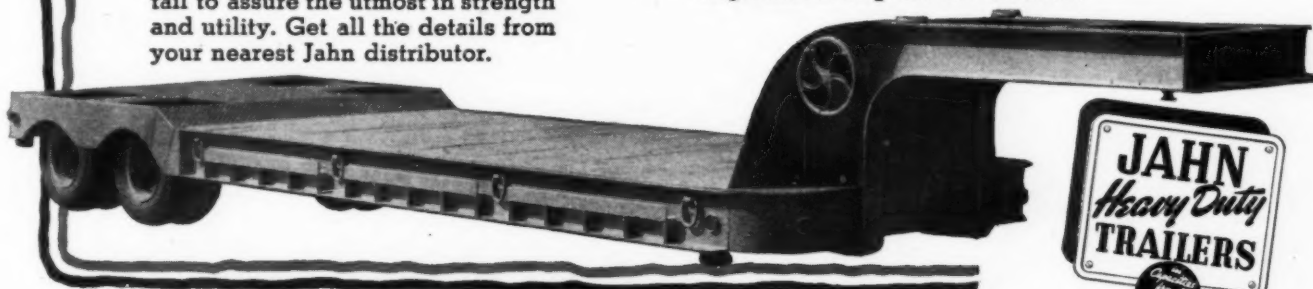
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The axle construction of a Jahn tandem axle, heavy-duty trailer is typical of attention given to every detail to assure the utmost in strength and utility. Get all the details from your nearest Jahn distributor.

1. Constant lift cam.
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3. Worm gear type slack adjusters at each wheel.
4. Heavy coil springs at each axle.
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- Spreads all materials to 1", wet or dry
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FLINK



Models WD31 and HD4 have protective cover pictured. Both cab controlled.

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The ideal machine for seal coating, road re-surfacing, dust control. Trouble-free, no working parts to attachment. Write.



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Pocket-size BITUVIA manual containing valuable road construction data will be sent on request.

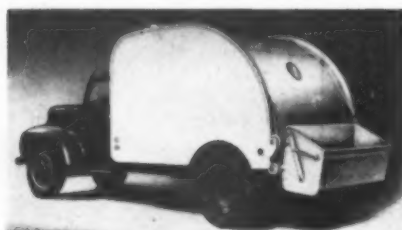
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known Gar Wood hydraulic hoist for dumping. The loading bucket is suspended at a low level to prevent undue



New Refuse Collector—The Bucket Loader

fatigue or injury to the loaders, and the controls are simple for quick and easy operation on the job. A full-opening, water-tight tailgate insures rapid and complete discharge of the load and easy accessibility for cleaning and flushing.

New Air Compressor

13. A 105 c.f.m. air compressor combined as an integral part with a 35 h.p. wheel tractor has been brought out by Le Roi Co., Milwaukee, Wis.

The air-power unit is entirely new, with 6 cylinders, utilizing all of the latest developments in industrial engine design. The cylinder block is one casting with hardened removable wet cylinder sleeves and precision, shell type bearings. The tractor unit is a Le Roi-Centaur mounted on 4 pneumatic tires. It has a five-speed transmission. The unit can be operated as a conveyor yet maintains full utility of tractor. Power surplus of engine is adequate to permit use as tractor and in addition maintain full

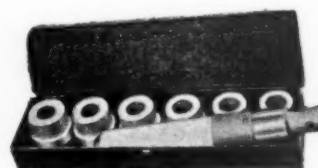


"Tractair" Compressor

head of compressed air. Numerous front and rear pneumatic, hydraulic, and mechanical attachments are available to further increase the usefulness of this new product.

New Bushing Driver Set

14. A new bushing driver set designed to install and remove bushings without damage has been added to the line of Owatonna Tool Co., 319 Cedar St., Owatonna, Minn. It includes six



New Bushing Driver Set

sizes of collars with one driving handle—to take care of the most popular sizes of bushings found on trucks, tractors and other heavy equipment. The set is furnished in a substantial metal box.

New 10-Inch Plastic Slide Rule

15. A 10 in. universal slide rule in plastic is now in production by the Frederick Post Co., Chicago, Ill. This snow-white professional grade instrument with razor sharp, easy to read graduations, has been named Plas-



The Quality Line!

WELLMAN

Williams Type BUCKETS

• You get longer service with less maintenance when you use Wellman Williams buckets because this quality line pioneered the field in welded construction of high-grade rolled steel. *Wellman-built means better-built!*

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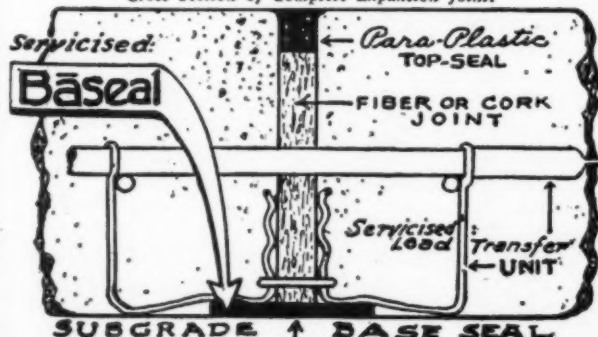
A SUBGRADE WATERSTOP!

Baseal is the latest contribution by Servicised to the Road Building Industry, a base-sealing strip as the name implies—new in purpose, performance, and design. A preformed, flexible, adhesive strip in a roll. Stops infiltration at the Danger Point at bottom of every Lateral Expansion Joint.

SELF BONDING

Baseal has this outstanding quality that after the wet concrete is poured on, sets up and becomes dry, a permanent bond is formed with the **Baseal**, which results in a perfect watertight joint between the two adjoining slabs and the base strip.

Cross Section of Complete Expansion Joint.



TIME AND LABOR SAVED

Baseal is a pliable adhesive strip of one quarter inch thickness, and of width (usually 3 to 8 inches) and lengths to conform to width of paving slab. A very important feature of **Baseal** is its high degree of cohesive, adhesive, resilient and permanent plastic properties. It is easily handled, and installed. Supplied in convenient roll form, each strip is treated to prevent pieces from sticking together in shipment or storage.

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Time-Tested for DURABILITY

Calcium chloride curing for concrete pavements is a reliable, economical and automatic curing method that speeds the work. It permits opening to traffic much sooner and adds to durability and wearing quality.



23 Years Old

This concrete road near Harrisburg, Pennsylvania, was constructed in 1923. Two pounds of calcium chloride per bag of cement were used in the mix. It is in very good shape today.

22 Years Old

Surface cured with calcium chloride in 1924, this Ohio road is in good condition today. Proper curing is important for durability of concrete.



20 Years Old

Integrally cured with calcium chloride in 1926, this concrete highway in Maine gives good service today with a relatively small amount of maintenance.



19 Years Old

Surface cured with calcium chloride in 1927, this New Hampshire pavement goes on performing the work for which it was constructed—traffic service.

CALCIUM CHLORIDE ASSOCIATION, 4145 Penobscot Bldg., Detroit 26, Mich.

CALCIUM CHLORIDE
for BUILT-IN CURING

Ten. It is furnished with a sturdy genuine heavy leather case.

New Cargo Hook

16. A new special safety cargo hook designed for U. S. Navy for transferring supplies and ammunition at sea underway, is reported to be applicable to many difficult hoist and loading problems. The hook, designed by the American Chain Ladder Company of New York, was developed especially to handle simultaneously three cargo nets with a total load of

3,500 lb. Since in loads of this kind it was necessary for the hook to carry twelve parts of $3\frac{3}{4}$ in. Manila in the grab, the American Chain Ladder Co.'s U. S. Navy Special hook was made with a grab opening of $3\frac{7}{16}$ in., while the diameter of the bail opening is $4\frac{1}{16}$ in. Recently the American Chain Ladder Co. added to their ACLC Safety hoist hook line new shank and shackle models. The new shackle (or clevis) hoist hook includes its own shackle, making an initial shackle unnecessary in threading the thimble.

MANUFACTURERS' LITERATURE

Rock Breaking Tools

17. Tools for facilitating the breaking of rocks are illustrated and described in a folder issued by Universal Pneumatic Tool Co., 722 Chestnut Ave., St. Louis, Mo. The items include the Maloney boulder buster which breaks rock by mechanical expansion, a drill steel guide for drilling a hole at any angle and in the precise spot desired, and a drill steel ejector designed to loosen drill steel that becomes stuck in the hole.

Contractor's Pumps

18. Useful engineering data are included in the catalog of its centrifugal pumps, issued by Carver Pump Co., Muscatine, Ia. Illustrations and descriptive matter on the features of these pumps are given, as well as specifications and performance data for each model. Data section includes: How to select proper size of pump; pump selection example; recommended suction lifts; and conversion tables.

Dozer-Shovel

19. A 24-page bulletin graphically depicting actual operating conditions of its dozer-shovel on a wide variety of digging, earthmoving and material handling jobs has been issued by Bucyrus-Erie Co., South Milwaukee, Wis. Sections pictorially describe such a feature of the machine as: low overhead clearance and generally compact design for high maneuverability; high visibility; maintenance of tractor balance; and smooth hydraulic control. The bulletin also illustrates the unit's versatility made possible by easy interchangeability from shovel to bulldozer, and vice versa.

Construction and Repair Equipment

20. Equipment for construction and repair of highways is the subject of a circular issued by Littleford Bros., Inc., Cincinnati, O. Illustrated and described are: Traction and power driven road brooms, supply tanks, "Spray Master" pressure distributor, Trail-O-distributor, and "Tankar" steam heater.



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SNOW PLOWS—MAINTAINERS—PATROLS**

**Special Tough Steel
Rolled to Shape
NOT REHEATED!**

NOW AVAILABLE for immediate delivery—LINCOLN ARMOR EDGE BLADES, guaranteed for long, heavy service. All types—curved or flat, single bevel or double bevel. Made in

our Lincoln plant of special high-grade steel for tough, heavy duty. Blades curved and beveled when made—never reheated. PUNCHED HOLES, positively guaranteed to fit accurately. Each blade rigidly inspected throughout entire manufacturing process. Write today for complete specifications and prices.

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TOUGH WIRE ROPE

For rugged, long-lasting wire rope be sure it bears the name Wickwire Spencer. Every step in the making of Wickwire Rope is under constant, careful control, from the special formulae used in making the steel, through processing of the wire until it is exact within a fraction of a thousandth of an inch, through laying of the strands and final closing.

Order Wickwire Spencer Wire Rope and be assured of the utmost in performance, safety and long rope life. It is available in all sizes and constructions—both regular lay and WISSCOLAY Preformed.

**HOW TO PROLONG ROPE LIFE
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Thousands of wire rope users—old hands and new—have found "Know Your Ropes" of inestimable value in lengthening life of wire rope. Contains 78 "right and wrong" illustrations, 41 wire rope life savers, 20 diagrams, tables, graphs and charts.

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Speed Reducers

21. A new 16-page bulletin entitled "Earle Speed Reducers as Applied to Operating Machinery," has been issued by The Earle Gear and Machine Co., Philadelphia, Pa. It contains useful engineering data and information of value in selecting the proper reducing unit for various needs. Fully illustrated, showing installations in movable bridges, ferry lifts, gates, dams and other types of machinery.

Cleaning Construction Equipment

22. Steam detergent cleaning methods for equipment are described in a booklet issued by Oakite Products, Inc., New York. Described in the booklet are many applications of steam detergent cleaning for (1) cleaning machinery equipment and parts for subsequent repair and overhaul, (2) preparing equipment surfaces for repainting or refinishing, (3) cleaning equipment too large for tank immersion, or where suitable tanks are not available, (4) paint stripping.

Automatic Clutch

23. A bulletin describing the BLM "Auto-Centri" and its application is

available from Hardinge Co., Inc., York, Penn., which recently obtained the manufacturing and sales rights from the Automatic Clutch Corporation of Canada. This automatic clutch, which is available in sizes from fractional horsepower to 5000 H. P. for any type of power drive, has been in service for several years and more than 10,000 installations have been made.

Protective Coatings

24. Protective coating materials are described in a circular issued by Reilly Tar and Chemical Corporation, Indianapolis, Ind. These coatings are for metal, brick, cement and wood surfaces. Specific types of steel surfaces are dealt with and recommended special applications of protective coatings for each type are described.

Concrete Densifier

25. The action and benefits of "Plas-timent" are described in an 8-page illustrated booklet issued by Sika Chemical Corporation, Passaic, N. J. This product is used in concrete to improve its characteristics in certain vital aspects, such as watertightness and surface hardness.

Power and Floodlight Sets

26. Important facts about stationary and portable power generator sets and portable floodlight units, plus a long list of their uses and advantages are incorporated in the illustrated bulletin recently prepared by Consolidated Diesel Electric Corporation, Mount Vernon, N. Y. The uses and advantages of both the power generator sets for stand-by and exclusive power source and the floodlight units for night work projects are fully explained.

Dump Bodies and Hoists

27. Heil bodies and hoists are illustrated and described in four informative bulletins issued by The Heil Co., Milwaukee, Wis. The bulletins cover: Heavy duty dump bodies and twin cylinder hydraulic telescopic hoists; twin arm hoists for heavy duty trucks; twin arm hoists and bodies for 1½ to 2½ ton trucks; and platform conversion hoists. The company has made 30 different improvements in the design and construction of its arm type hydraulic hoists over its pre-war models.

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THE NEW WIRE ROPE CLAMP That Really Holds the Line!

CABL-OX clamps work on a brand new wedging principle. Holding power increases with the load and exceeds tensile strength of rope used. Does not crush and weaken rope like old style U-clips. Assembly is fast, neat . . . saves breakdowns, equipment, injuries and expense. Can be used over and over. Cadmium plated.

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now insures efficiency and long life for engine as well as pump




Model 2P

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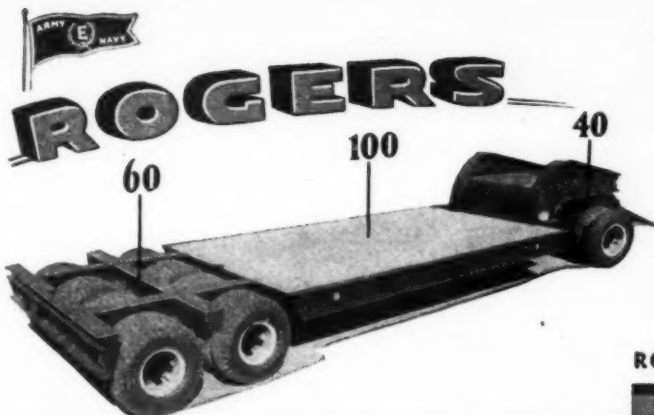
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Instant-opening side panels. Enclosures also lift off or swing open for complete access.

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This provides the necessary traction—distributes the load properly over all tires—and greatly improves the haulability and brakeability of both tractor and trailer.



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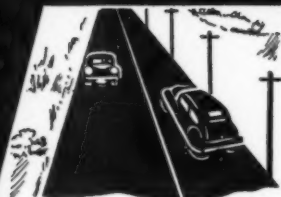
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Emulsified Black complies with State specifications. A colloidal dispersion of not less than 25% carbon black, it flows freely, working immediately into the mix. Emulsified Black requires no pre-mixing, and is easy and clean to handle. For further information write to

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YES... THEY'RE ALL OWEN BUCKETS

6070 Breakwater Ave., Cleveland, O.



Lifts 3,000 Pound Load 8 Feet

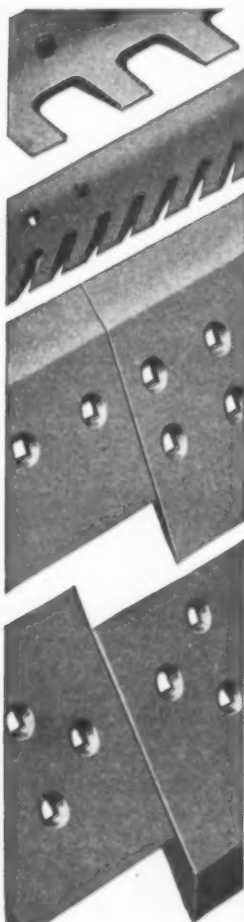
The "Ottawa" INDUSTRIAL Hydraulic Front-End LOADER is a HEAVY DUTY Machine... it lifts 3000 pounds of Sand, Gravel, Rock, Coal, Steel Pipe, Dirt or Other Bulk Materials to a height of 8 feet quickly and easily... it assures operator perfectly CLEAR VISION at all times, is quickly and simply ATTACHED or DETACHED and is SHIPPED COMPLETE (there's absolutely nothing additional to buy or add) with complete HYDRAULIC SYSTEM including pump and valve. Bulldozer blade, Snowplow and Boom attachments are available. Write or wire today for FREE ILLUSTRATED FOLDER and prices. Immediate shipment.

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ALLIS-CHALMERS
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Shunk GRADER AND SCARIFIER BLADES

For any type or make of machine—Motor Graders, Maintainers, Scrapers, Drags, Bulldozers, Backfillers, Wagon Scrapers, Trail Builders, Trail Blazers, Carryalls, Snow Plows, Also—CUTTING EDGES, WEARING BOOTS, BACK SLOPERS, EXTENSION BLADES, MOLDBOARDS and SCARIFIER TEETH

50 years of specializing in the manufacture of Construction Equipment Blades has developed for your benefit a quality of special steel, milled through our own rolls and forged at the edges to give that extra cutting and wearing quality you need.

Furnished in various widths, lengths, and thicknesses, punched ready to fit your machine.

Consult your internationally recognized Blade Specialists. Write for special bulletins, giving type and name of machines you operate—get set for Blades early.

Shunk
MANUFACTURING
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Established 1854
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Motor Generator Sets, Etc.

28. A brochure covering a preview of its products has been released by Motor Generator Corporation, Troy, O. It includes new equipment developed during 1941 to 1945. Products included are motor generator sets, battery charging sets, electric power units and buffers and grinders.

Concrete Mixers

29. A bulletin published by Chain Belt Co., Milwaukee, Wis., describes its new Rex 11S and 16S concrete mixers. Mechanical details such as 3-way mixing action, chain drum drive, shimmy skip, accurate water system, 1-man hitch, etc., are illustrated and described. Complete specifications on all parts of the mixers also are included.

Power Units

30. Chrysler industrial engines are illustrated and described in a 72-page catalog issued by Chrysler Industrial Engine Division, Chrysler Corporation, Detroit, Mich. General specifications are given for 7 models, as well as power curves and general details of the engine assembly for these models. Details of the basic engine features and the accessories also are pictured and described.

Underwater Cutting and Welding

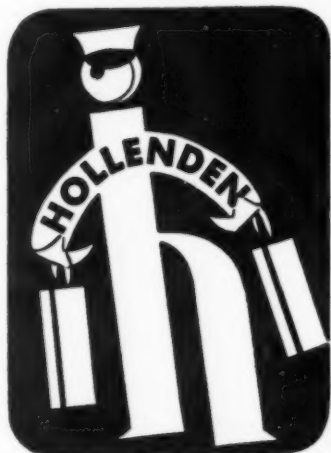
31. Underwater cutting and welding is covered in a 10-page booklet issued by Metal & Thermit Corporation, New York, N Y. The booklet describes the arc-oxygen process for the cutting of steel under water and for cutting cast iron and high alloy steels in the open air and gives considerable working data and procedure information. In addition, Murex electrodes for welding and for cutting light gauge materials under water are covered and instructions for their use are included.

(Continued from page 86)

in most any other expenditure of money, we get about what we pay for.

Maintenance men have had a terrific job to do during the war years. In most cases they have handled their expanded responsibilities in creditable manner despite the handicaps of restrictions on men, materials, machinery and money. Lest some of you

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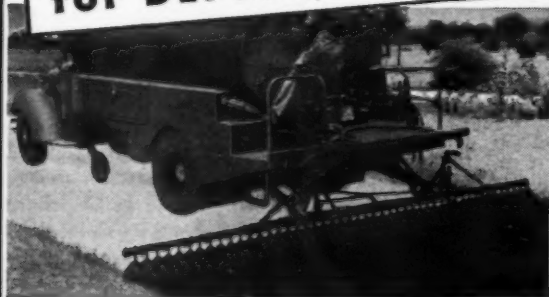


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Use a Load Lugger on your truck with 5 to 10 detachable dump buckets. Saves time, conserves man-power and cuts costs on jobs involving hand-labor loading.



With TrucKane boom attachment for handling and placing tile, sewer pipe, steel beams or timbers.

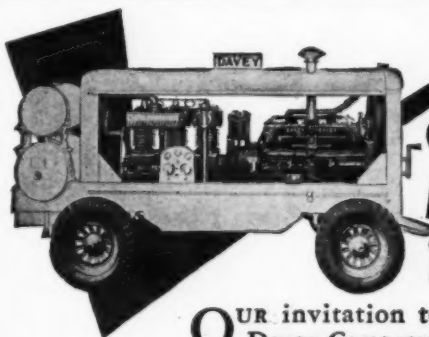
Valuable equipment for counties and communities for road building, street repairs, sewer work, refuse disposal, park improvement, and miscellaneous hauling of fuel, ashes or any bulk materials, wet or dry. Write for information on the many applications of the Load Lugger.

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D-945-20

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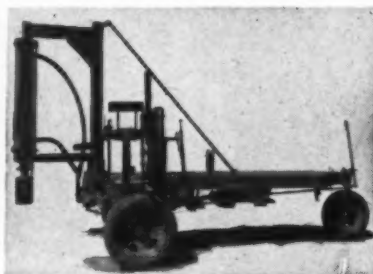
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**2-4D WEED KILLER
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Agricultural Chemicals and Hormones
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Cuts concrete and cuts labor costs to 2 1/2 c per square yard. Applicable to floor work and different types of inside horizontal work.

Very efficient in maintenance work of highways.

Boom folds down and readily trailed by any light truck. Make your compressor treble its output by hooking it to this machine.

**Rapid Pavement
Breaker Co.**

1517 Santa Fe Ave.
Los Angeles 21, Calif.

think my remarks have been too critical of maintenance men, let me say now that I think they are the most important group in any highway organization. Their work is not cut and dried for them and set forth in handbooks and tables as it is for most other highway groups. Their work in most cases is based on good judgment and, in the many emergencies they face, that judgment has to talk fast. Almost every day something pops up, the answer to which is not in the rule book.

Calls for Experience

Most people, and unfortunately some top road officials, seem to have the idea that any Tom, Dick or Harry can handle maintenance work. This is far from being correct. It is just as difficult to properly maintain roads as it is to locate, design or build them. Good maintenance judgment is acquired by practical experience and can't be picked up in a month or a year. When you find a good maintenance man developing in your organization, hold on to him by all means! The preservation of the billions of dollars invested in our roads rests almost entirely on their shoulders. When I see one of those 100% turn-overs in a county or state road maintenance department just because the political complexion has changed in that area, I am vividly reminded of the fact that I am too dumb to ever become a politician, for the simple reason that with my limited brain power I just can't understand how such a policy is either good business, good sense, or good politics.

Practically all voters use the roads, or at least depend on them for many of the necessities of life, and I can't see how their continued political support will be encouraged by letting the roads deteriorate for a couple of years while the new and inexperienced maintenance men find out what it is all about.

Before I close, let me pat the maintenance men on the back with another idea of mine. Why wouldn't it be a good idea to call maintenance men the Undertakers, or should I say Morticians, of the highway department? Much of their time and energy is devoted to burying the mistakes of the location, design and construction departments. Think it over!

It wouldn't be a bad idea to require that every location, design and construction engineer, at some time or other, serve for six months or a year with maintenance crews to learn at first hand just why they should not do some of the things they have been doing.

Well, this is about enough from a side-line quarter-back trying to tell the actual players in the field what to do. Let me wind up with this thought. It might be a good idea to give some serious thought to the possibility that our continued expansion of new road construction may eat up so much of the total available funds that our maintenance departments will be short-changed more and more each year until it will be impossible for them to keep the whole road system up to desirable standards. A slogan which the Wisconsin State Highway Department carried on some of its publications years ago expresses what I am driving at. It ran something like this, "Let's keep what we have 'til we get more to keep."

As the radio announcer would say it, the views presented in this paper are my own and not necessarily those of my sponsor, Purdue University.

WITH THE MANUFACTURERS & DISTRIBUTORS

Appointments by Gar Wood Industries

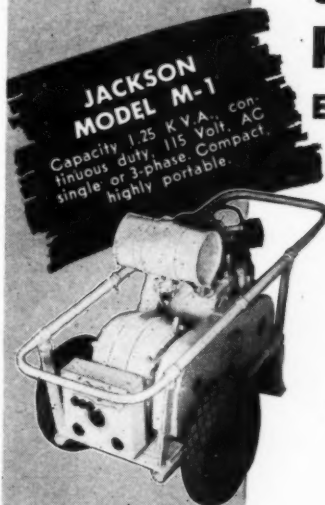
R. J. Nymberg has been named sales manager of the hoist and body division of Gar Wood Industries, Inc., Detroit, Mich. He joined Gar Wood in 1921 as a body engineer, and was made sales engineer in 1932. Other appointments follow: Henry Husbands has been named to assist Amos E. Heath, district manager of the company's general line in Washington, in contacting government agencies. Mr. Husbands was formerly with the Navy Bureau of Aeronautics. Ross Miller, district manager—general line, is acting temporarily as manager of Gar Wood's Philadelphia branch (hoist and body division), succeeding A. E. Hilderley, retired. Edward F. Kreutzfeld has been named service manager of the hoist and body division to succeed Mr. Miller. William F. Keeton has been placed in charge of the company's newly-created advertising department. Charles J. Hoffman has been placed in charge of Gar Wood's newly-formed export department.



R. J. Nymberg

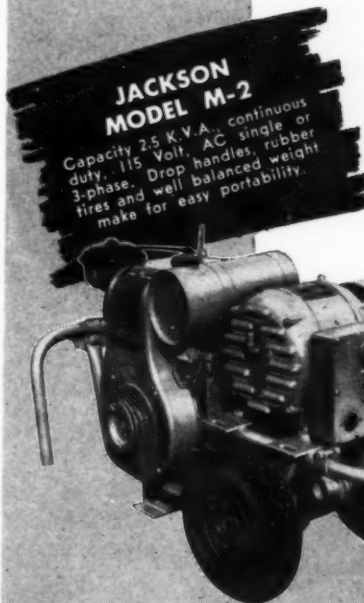
Continuous DAY IN and DAY OUT Dependability

SUCH AS NO PORTABLE POWER PLANTS EVER BEFORE POSSESSED



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Capacity 1.25 K.V.A., continuous duty, 115 Volt, AC single or 3-phase. Compact, highly portable.

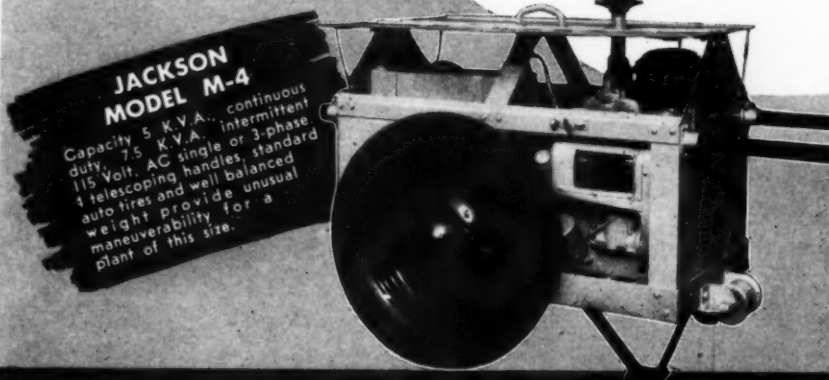
You'll save yourself a wad of dough if the new Portable Power Plant you buy is one of the new JACKSONS. For these plants completely eliminate the time commonly lost when generator troubles arise. A gang held up for 15 minutes while a generator is adjusted or a brush replaced, in the aggregate means hours and dollars lost.



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MODEL M-2**
Capacity 2.5 K.V.A., continuous duty, 115 Volt, AC single or 3-phase. Drop handles, rubber tires and well balanced weight make for easy portability.

Each JACKSON Plant has a new type, permanent magnet generator which requires no adjustment, no maintenance; is practically trouble-proof. And they deliver full rated capacity in single phase as well as 3 phase, 115 Volt, A.C. power. Add to this the fact

that they incorporate the most reliable of engines and quality construction throughout and you have **DEPENDABILITY** such as no other Power Plant has ever possessed — the finest possible source of power for operating Floodlights, a wide range of power tools, concrete vibrators and vibratory screeds. Get the facts. Write NOW!



**JACKSON
MODEL M-4**
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to apply and remove Sisalkraft blankets. It's the fast, cheap method.

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at one low cost.

Manufacturers of SISALKRAFT, FIBREEN,
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Bastian Joins Tyson

Paul J. Bastian has been appointed vice-president in charge of manufacturing for Tyson Bearing Corporation, Massillon, O. Mr. Bastian was identified with Curtiss Airplane and Motor, Buffalo, N. Y., for ten years, and was manufacturing manager for Wright Aeronautical Corporation, Paterson, N. J., for 15 years. Recently he resigned his position as production manager of Watson Flagg Machine Co., to assume his new duties with Tyson.

Wernisch Back With Ceco

George R. Wernisch, recently discharged lieutenant commander, has been appointed assistant manager of the concrete engineering division of Ceco Steel Products Corporation. He will make his headquarters at the firm's manufacturing division plant in Chicago.



G. R. Wernisch

Before entering the Navy as a lieutenant, j.g., in 1942, Mr. Wernisch served as a designer, sales engineer, and assistant manager of the company's steel joist and deck division. While in the Navy, he spent 2½ years in charge of the steel section, Bureau of Yards and Docks.

Garnjobst Back With AL&T

Henry Garnjobst, who organized and operated the American Lumber & Treating Co. news bureau during 1940 and 1941, and after Pearl Harbor, was transferred to the company's Washington office to handle Government relations work, has returned to the AL&T general office in Chicago and will be responsible for national publicity activities.

Consolidated Diesel Erects New Plant

Consolidated Diesel Electric Corp., manufacturers of electric generating sets since 1932 has erected its own building at 230 East 8th St., Mount Vernon, N. Y. The new plant, designed by Consolidated engineers, has a total manufacturing space of 33,000 sq. ft. Office space will occupy two floors with a total of 6,000 sq. ft.

Galvin Named Sales Head La Plant-Choate

E. R. Galvin, formerly president Tyson Bearing Corporation, Massillon, O., has been named executive vice-president, general sales manager and member board of directors of La Plant-Choate Manufacturing Co., Inc., Cedar Rapids, Ia. Mr. Galvin's resignation as president of Tyson became effective Feb. 28, and on March 1 he assumed his new duties with La Plant-Choate. S. L. Myers, who has been vice-president and general sales manager during the past year, becomes vice-president and export sales manager, while Jay M. Fetter, former export manager, becomes manager of foreign development. Prior to his association with La Plant-Choate and Tyson, Galvin was general sales manager of R. G. Le Tourneau, Inc., of Peoria, Ill. He also served as general sales manager of Caterpillar Tractor Co. of Peoria from 1927 to 1938. Prior to that time he served two years as general sales manager of the Cleveland Tractor Co., Cleveland; and seven years as director of sales for the smokeless powder division of E. I. DuPont de Nemours & Co., Wilmington, Del.



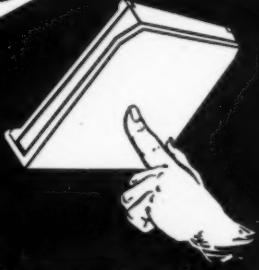
E. R. Galvin

New Officials American Chain

Wilmot F. Wheeler has been elected president American Chain & Cable Co., Inc., Bridgeport, Conn., succeeding the late William T. Morris. Mr. Wheeler has been with the company since 1916, was elected a director in 1919 and treasurer in 1920. He has been executive vice president and treasurer since 1936. Cyrus N. Johns has been elected executive vice-president. Mr. Johns joined the Page Steel and Wire Co., now a division of American Chain & Cable Co., Inc., in 1913, and was made general manager of that division in 1933. In 1937 he was elected a director of the company and in 1940 vice president in charge of operations of all plants. Stanley Mann has been elected treasurer. He has been a director of the company since 1936 and assistant treasurer since 1943. Mr. Mann was treasurer of Standard Chain Co. when it was acquired by American Chain & Cable Co., Inc., in 1917.


*Which Gives--
More Efficient Lifting?*

ONE FINGER



Concentration of power thrust in a small area increases strains of unbalanced loads. It requires more effort--and produces excess wear on a hoist and body.

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With PERFECTION'S scientific understructure construction, the power thrust from the hoist is delivered--not to a single bolster or small cross-



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Austin Power Pick-up Sweeper
Completely rebuilt
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3—Steam Tandem Rollers (Prices vary

1—Barber Asphalt Plant, 2,000 lb. box 1,500.00

1—Acme Stone Crusher, screens and elevator equipped with McCormick-Deering power unit 1,200.00

1—Barber-Greene Ditcher... 2,500.00

2—Drott Universal Bull Clam Shovels, each 750.00

1—Buckeye Sub Grader, 10' to 12' 3,250.00

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Late model BROOKS LOAD Luggers, CH-200, including 2 cu. yd. buckets, \$750.00;

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CHIEF DESIGNING ENGINEER

for road building, material handling, and heavy automotive equipment. A man who has had wide experience in these fields as well as in high pressure hydraulics. Capable of assuming full responsibility for an engineering department of 15 engineers and draftsmen. State age, experience, qualifications and salary requirements. Confidential. Position in Middle-West. Box 101, Roads & Streets, 330 So. Wells Street, Chicago 6, Ill.

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Asst. Sales Mgr. Const. Equip. Man with successful record selling dirt moving equip. for an exceptional opportunity with large Eastern distributor. Good salary, expense and commission.

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Western Corp. desires applicants for sale of Highway Equip. to Highway Commissions, contractors, and heavy equip. users in West. Work out of Denver office. Qualifications: Grad. Engr. or equiv. field exp. in highway or heavy constr. work. Five yrs. exp. in sales of steel or heavy equip. Age 30 to 40. Salary open. Apply by letter.

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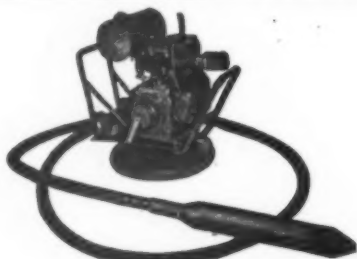
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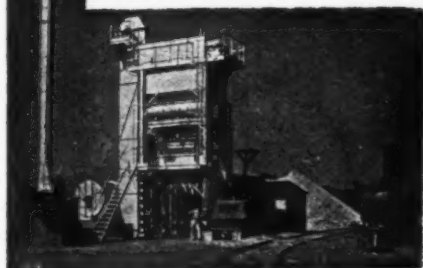
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Appointed Export Manager

W. A. Finn has been appointed export manager of Worthington Pump and Machinery Corporation, Harrison, N. J. He has just been released from the U. S. Navy. He succeeds George Gellhorn, who has accepted a position of general manager of C. E. Halaby, one of Worthington's industrial machinery dealers in Colombia, South America. Before the war, Finn was manager of Worthington's Boston district office. His new headquarters will be in Harrison, N. J.

New Le Roi District Managers

William J. Bancroft has been appointed western district manager for Le Roi Co., Milwaukee, Wis., with headquarters in San Francisco. After graduation from the Colorado School of Mines in 1936, Mr. Bancroft was commissioned 2nd lieutenant and spent a year in the regular army. For 3½ years following he was associated with the Sullivan Machinery Co. Early in 1941 he was recalled to active duty in the Engineer Corps, U. S. army. When he retired from army service he had



W. Z. Bancroft



T. V. Shea

reached the rank of lieutenant-colonel. The Le Roi Co. also has announced the appointment of Thomas V. Shea as eastern district manager, with headquarters in New York City. Mr. Shea is a graduate of University of Wisconsin. From 1939 to 1943 he was associated with Phillips Petroleum Co. as a sales engineer, later becoming assistant manager of operations of Phillips Industrial Division. In 1943 he became staff engineer and general supervisor of fuel systems and equipment for A. O. Smith Corp. in Milwaukee.

New Hewitt Distributor

Southworth Machine Co., Portland, Me., has been appointed Maine distributor for Hewitt Rubber Corporation's line of industrial hose, conveyor belts and transmission belts.

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It costs but a few cents per cubic yard to dig, haul and place a big load of any material with a SAUERMAN Power Drag Scraper or Slackline Cableway. The low cost and large capacity of these machines is proved daily on hundreds of jobs.

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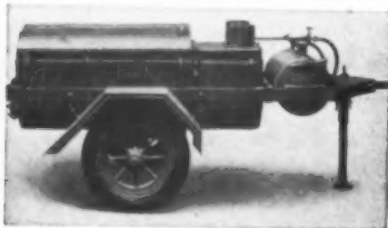
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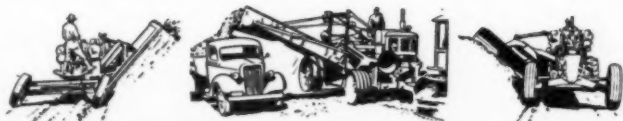
What's more, in Adams Motor Graders you get a host of other features essential to efficient, long-life performance . . . rugged strength—rigidity—balanced weight distribution—fast, accurate blade controls—wide range of usefulness—minimum operating and maintenance costs.

Phone or visit your local Adams dealer. He will gladly show you why it's always good business to specify Adams Motor Graders.

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New Worcester Municipal Airport has shock-absorbing Texaco runway



Heavy-duty Texaco Asphaltic Concrete paving, 4 inches thick and 150 feet wide, serves the three runways of Worcester's modern municipal airport.

Worcester, Mass., again demonstrates why it is recognized as one of New England's most progressive cities. Long aware of the boom in air transportation which would follow the war, Worcester carefully prepared its plans, which have now materialized in the city's modern new airport.

The three runways of Worcester's airport range from 3,750 to 5,500 feet in length. They are supported by a gravel base 18 inches thick, on which is laid 4 inches of bituminous penetrant macadam. The wearing surface consists of a 4-inch thickness of resilient, heavy-duty Texaco Asphaltic Concrete paving, laid in three courses.

That Worcester's Texaco Asphalt runways are more than adequate for the heaviest peacetime air traffic has been proved conclusively by millions of square yards of Texaco-paved runways on U. S. Army and Navy flying fields.

Texaco Engineers, who are Asphalt specialists, will be glad to discuss your airport paving problem with you. Write our nearest office.

Laying Texaco Asphaltic Concrete wearing surface on Worcester airport runways.



Crowd greets the first plane to land at the new Worcester Municipal Airport.

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